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NUCLEAR SCIENCE ABSTRACTS

Volume 11 May 31, 1957 No. 10

GENERAL

ATOMIC BOMBS AND WARFARE

5125 NAVORD-2007
Naval Ordnance Test Station, Inyokern (China Lake), Calif.
ATOMIC CLOUD SAMPLING WITH ROCKETS: DEVELOPMENT OF THE TECHNIQUE. H. T. Lotee, O. L. Mitchell, and J. M. Brower. Jan. 13, 1953. 33p. (NOTS-627).

A sampler rocket consisting of a specially designed head adapted to a rocket motor was developed to give a prescribed trajectory in the course of which the head will take a sample of airborne particles from an atomic cloud and then seal on impact with the ground. The firing of sampler rockets is controlled by a combination of the rocket launcher and either or both of two specially developed timers. Twenty launchers can deliver, on signal and at prescribed intervals, 80 rockets in one, two, or four equal salvos. A criticism is made of the sampler rocket developed, and a proposal is given for an improved sampler head. (auth)

ATOMIC POWER

5126 DL-15
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
CANADIAN POWER DEVELOPMENT — FUTURE POSSIBILITIES. Paper Presented to the Couchiching Conference, August 12, 1954. W. B. Lewis. Aug. 1954. 19p. (AECL-131).

5127
NUCLEAR REACTORS FOR INDUSTRIAL USE. D. J. Allen-Williams and M. D. Whitworth (Davey, Paxman and Co. Ltd.). Nuclear Eng. 2, 103-6(1957) March.

The economies in coal and oil to be realized from the use of nuclear power are discussed. The cost of reactor generated steam is compared with coal or oil generated steam. Some practical applications for the direct use of nuclear energy are given. (T.R.H.)

BIOLOGY AND MEDICINE

5128 AECU-3272
Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
THE EFFECT OF FOREIGN BODY PARTICLES ON INFECTIONS IN MICE. William E. Clapper and Grace H. Meade. Aug. 15, 1955. 35p. Contract AT(29-1)-1242. $0.25(OTS).

Foreign body particles implanted under the skin by a blast may also be contaminated with bacteria. The purpose of this investigation is to determine what effect, if any, these particles may have on some bacterial infections in mice and particularly, infections produced by organisms commonly found in soil. (auth)

5129 AERE-Med/R-2098
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
AN INVESTIGATION OF THE URINARY EXCRETION OF ENDOGENOUS CREATININE FROM A GROUP OF MALE HUMAN SUBJECTS. B. W. Oakley. Nov. 1956. 11p.

5130 BNL-396
Brookhaven National Lab., Upton, N. Y.
GENETICS IN PLANT BREEDING. REPORT OF SYMPOSIUM HELD MAY 21 TO 23, 1956. Brookhaven Symposia in Biology No. 9. 243p. $1.25(OTS).

Recent developments in genetic research which are of potential value in plant breeding were discussed at this symposium. (C.H.)

5131
THE EFFECTS OF A HIGH EXPLOSIVE BLAST IN MICE WITH RADIATION INJURY. Carl-Johan Clemedson and Arne Nelson (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Radiol. 47, 79-85(1957) Jan.

RADIATION EFFECTS

5132 ACRH-6
Argonne Cancer Research Hospital, Chicago.
SEMIANNUAL REPORT TO THE ATOMIC ENERGY COMMISSION. Leon O. Jacobson and Antreen Pfau, eds. Sept. 1956. 116p. Contract AT-(11-1)-69. $0.60(OTS).

Progress is reported in the following studies: histochemical studies on normal dog hearts and hearts following the experimental production of well-defined defects in the cardiac conduction system produced by radiation from β-ray point sources; the catabolism of urea by rats following total-body irradiation; tracer studies on the iodination of serum proteins and thyroid metabolism; and the mechanism of tritium labeling of organic compounds by recoil tritons generated in the $Li(n,\alpha)T$ reaction. Data are presented on the preparation of tritium-labeled substituted benzenes. Summaries of papers presented, papers accepted for publication, and a list of staff publications during the period are included. (For preceding period see ACRH-5.) (C.H.)

5133 AECU-3418
Utah. Univ., Salt Lake City. Radiobiology Lab.
ANNUAL PROGRESS REPORT. Mar. 31, 1955. 59p. Contract AT(11-1)-119. $9.30(ph OTS); $3.60(mf OTS).

Progress is reported in studies on the toxic effects of radioactive heavy metals in dogs. Data are included on the pathological effects, metabolism, and bone deposition of Pu, Ra, Ra^{224}, Ra^{228}, Th, Th^{228}, Sr^{85}, Sr^{89}, Sr^{90}, and Y^{90}; the effects of irradiation on the skeletal uptake of Sr; the hematological effects of internally deposited Pu and Ra; and the role of Th^{228} in Ra poisoning. A list of publications during the period is included. (C.H.)

5134 ORO-160
Tennessee. Univ., Knoxville.
AGRICULTURAL RESEARCH PROGRAM. Semi-Annual Progress Report for January 1, 1956 to June 30, 1956. 65p. Contract AT-40-1-GEN-242. $0.40(OTS).

Progress is reported on the following studies: factors

influencing the excretory pattern of Cs^{134} in rats; the influence of natural feedstuffs on metabolism of Cs^{134} and K^{42} in swine; the development of methods for in vivo estimation of total body water in sheep; tracer studies on the effects of vitamin D on Ca metabolism in calves; tracer studies on the effect of massive doses of vitamin D on the excretion of phosphorus in cattle; the effect of fluoride on carbohydrate metabolism in domestic animals; and pathological effects of fractional daily gamma irradiation on swine and burros. The status of a plant and seed irradiation project is discussed. (For preceding period see ORO-150.) (C.H.)

5135 UCRL-3574
California. Univ., Berkeley. Radiation Lab.
THE EFFECT OF DIAGNOSTIC DENTAL RADIOGRAPHY ON THE LYMPHOCYTE COUNT AND ON THE DIURNAL TIDE OF HUMAN LEUKOCYTES. R. Lowry Dobson and Mary M. Chupp. Oct. 26, 1956. 12p. Contract W-7405-eng-48. $0.15(OTS).

Total leukocyte and differential counts were done on eleven normal persons at hourly intervals for 12 hours beginning immediately after full-mouth dental radiography. These counts were compared with a control set obtained 1 or 2 days previously. A diurnal tide consisting of a rise in granulocytes and lymphocytes during the day was seen in these normal individuals before irradiation. A significant depression in the absolute lymphocyte count was observed during the period immediately after x-irradiation. No change in the levels of circulating granulocytes was apparent. Bilobed and binucleated lymphocytes were seen in the circulating blood before and after irradiation. The numbers of these cells seen were small, and it is not possible at this time to correlate changes in their incidence with dental radiography. (auth)

5136 UCRL-3653
California. Univ., Berkeley. Radiation Lab.
BIOLOGY AND MEDICINE QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER 1956. Jan. 28, 1957. 51p. Contract W-7405-eng-48. $0.35(OTS).

Data are presented from the following studies: the growth of osteogenic sarcoma transplants in rats; the effect of thyroid hormone therapy after large doses of I^{131} in rats; the radiation chemistry of formic acid solutions and systems; the radiation chemistry of pepsin solutions; tracer studies of iron metabolism in anemia; tracer studies of the life span of human erythrocytes; tracer studies on leukocyte life spans in normal, irradiated, and leukemic mice; tracer studies on carbon metabolism in diabetes; and lymphocyte response to low-level radiation exposure in man. Health chemistry and health physics activities for the period are summarized. A list of papers presented or published during the period is included. (For preceding period see UCRL-3573.) (C.H.)

5137 UR-481
Rochester, N. Y. Univ. Atomic Energy Project.
FLASH BURN STUDIES: LIMITATIONS OF A 2+ MEDIAN EFFECTIVE EXPOSURE SCALING LAW. R. E. Roth and J. R. Hinshaw. Feb. 4, 1957. 10p. Contract W-7401-Eng-49. $1.80(ph OTS); $1.80(mf OTS).

The data pertinent to the estimation of median effective exposures for 2+ burns of bare porcine skin caused by square pulses of radiant thermal energy are surveyed. Although a single scaling factor can be determined, at best it represents only a rough estimate of the relationship between radiant exposure and exposure time in the production of 2+ burns. (auth)

5138 USNRDL-TR-128
Naval Radiological Defense Lab., San Francisco.
THE EFFECT OF DOSE RATE UPON IRON INCORPORATION INTO NEWLY FORMED ERYTHROCYTES OF RATS EXPOSED TO GAMMA RADIATION. S. J. Baum and D. J. Kimeldorf. Dec. 20, 1956. 14p. Project NM-006-015.

5139
EXPERIMENTAL INVESTIGATIONS ON CATARACT FORMATION FOLLOWING WHOLE-BODY ROENTGEN IRRADIATION. Erik Poppe. Acta Radiol. 47, 138-48(1957) Feb.

5140
EXPERIMENTAL INVESTIGATIONS ON THE INFLUENCE OF ROENTGEN IRRADIATION ON THE GROWTH OF MULTIPLE TUMORS. Antero Voutilainen (Univ. of Helsinki and General Hospital, Helsinki). Acta Radiol. 47, 149-56(1957) Feb.

5141
EFFECT OF WHOLE BODY X-IRRADIATION ON PLASMA AND INTESTINAL CHOLINESTERASE AND ON DRUG RESPONSES OF ISOLATED INTESTINAL LOOPS IN THE RHESUS MONKEY, RAT AND GUINEA PIG. Arthur B. French and Patricia E. Wall (Univ. of Utah Coll. of Medicine, Salt Lake City). Am. J. Physiol. 188, 76-80(1957) Jan.

5142
CHANGES IN THE CARDIOVASCULAR SYSTEM FOLLOWING TOTAL BODY X-IRRADIATION. W. O. Caster, W. D. Armstrong, and Ernst Simonson (Univ. of Minnesota, Minneapolis). Am. J. Physiol. 188, 169-77(1957) Jan.

5143
INVESTIGATIONS ON STERILITY AND DEFORMITIES OF ONTHOPHAGUS (COLEOPTERA, SCARABAEIDAE) INDUCED BY GAMMA RADIATION. Henry F. Howden (Univ. of Tennessee, Knoxville and Oak Ridge National Lab., Tenn.). Ann. Entomol. Soc. Amer. 50, 1-9(1957) Jan.

5144
CELLULAR RADIOBIOLOGY. L. H. Gray (Mount Vernon Hospital, Northwood, Middlesex, Eng.). Ann. Rev. Nuclear Sci. 6, 353-422(1956).

Cellular radiobiology has been considered to include a study of the effects of irradiating organized tissues as well as cells, but not the whole organism, at least when this is a mammal. Papers published in the open literature during the calendar year 1955 are reviewed with no attempt made to cover the reports from individual laboratories under contract to the A. E. C. In one section, papers are grouped according to the problems which they attempt to illuminate and are mainly concerned with some aspects of the mode of action of radiation. In the other section the remaining papers are grouped in relation to classes of cells or tissues whose reaction to irradiation is described. 380 references. (L.M.T.)

5145
VERTEBRATE RADIOBIOLOGY: EMBRYOLOGY. John P. O'Brien (Marquette Univ., Milwaukee, Wisc.). 423-51 (1956).

The above subject is reviewed under the following categories: (1) Radiobiological Mechanisms — The primary aim is the elucidation of processes stemming from the first impact of radiation on the developing system to the earliest and later chemical and biological responses; (2) Morphogenetic Mechanisms — The clarification of the mechanisms and principles of vertebrate development is attempted; (3) Clinical Embryology — Immediate clinical observations are included, with such implications for medicine as may be suggested from investigations more immediately related to the above categories. 67 references. (L.M.T.)

5146
THE IRRADIATION OF INDIVIDUAL PARTS OF SINGLE CELLS IN TISSUE CULTURE WITH A MICROBEAM OF α-

PARTICLES. Marguerite Davis and C. L. Smith (Univ. of Cambridge, Eng.). Exptl. Cell Research 12, 15-34(1957) Feb.

A method of irradiating parts of single cells in tissue culture on a microscope stage with beams of α-particles 1μ to 1.5μ in diameter is described with the necessary ancillary apparatus. Two examples are given of cell abnormalities produced by such irradiations as series of phase contrast photomicrographs taken from a ciné film and photomicrographs of the stained cultures at the end. (auth)

5147

AN INFLUENCE OF PLOIDY ON THE TIME OF EXPRESSION OF DOMINANT LETHAL MUTATIONS IN HABROBRACON. K. C. Atwood, R. C. von Borstel, and A. R. Whiting (Oak Ridge National Lab., Tenn. and Univ. of Pennsylvania, Philadelphia). Genetics 41, 804-13(1956) Nov.

5148

THE INDUCTION OF RECESSIVE LETHALS IN DROSOPHILA MELANOGASTER BY RADIATIONS OF DIFFERENT ION DENSITY. Charles W. Edington (Oak Ridge National Lab., Tenn.). Genetics 41, 814-21(1956) Nov.

5149

STUDIES ON DIFFERENT CLASSES OF MUTATIONS INDUCED BY RADIATION OF DROSOPHILA MELANOGASTER FEMALES. R. C. King, Jean B. Darrow, and Nancy Weber Kaye (Brookhaven National Lab., Upton, N. Y.). Genetics 41, 890-900(1956) Nov.

5150

THE EFFECT OF COBALT-60 GAMMA RADIATION ON TETANUS ANTITOXIN FORMATION IN MICE. William M. Hale and Richard D. Stoner (Univ. of Tennessee, Memphis and Brookhaven National Lab., Upton, N. Y.). J. Immun. 77, 410-17(1956) Dec.

5151

ANTIBODY RESPONSE OF LETHALLY X-IRRADIATED MICE TREATED WITH RAT BONE MARROW. Nazareth Gengozian and Takashi Makinodan (Oak Ridge National Lab., Tenn.). J. Immunol. 77, No. 6, 430-6(1956) Dec.

5152

THE INFLUENCE OF IONIZING RADIATION ON THE BODY COMPOSITION OF PATIENTS WITH MALIGNANT LYMPHOMA. Joseph Greenberg and Daniel Laszlo (Montefiore Hospital, New York). J. Lab. Clin. Med. 49, 514-25(1957) April.

5153

RELATIONSHIP BETWEEN CHANCES OF SURVIVAL AND REGENERATION OF HEMATOPOIETIC TISSUE IN IRRADIATED RATS. J. Van Lancker (Univ. de Louvain, Belgium). J. Nat. Cancer Inst. 18, 407-12(1957) March.

5154

POLYPLOIDY AND RADIOSENSITIVITY. M. S. Swaminathan and A. T. Natarajan (Indian Agricultural Research Inst., New Delhi). Nature 179, 479-80(1957) March 2.

5155

THE EFFECTS ON PLANTS OF CHRONIC EXPOSURE TO GAMMA RADIATION FROM RADIOCOBALT. A. H. Sparrow and J. E. Gunckel. Proc. Intern. Conf. on the Peaceful uses of Atomic Energy 12, 52-9(1956).

5156

STUDIES ON THYMUS OF MAMMAL. X. REGENERATION OF IRRADIATED MOUSE THYMUS. Christianna Smith and Dorothy Anne Kieffer (Mount Holyoke Coll., South Hadley, Mass.). Proc. Soc. Exptl. Biol. Med. 94, 601-5(1957) March.

5157

THE SENSITIVITY OF DIFFERENT STAGES IN OOGENESIS TO THE RADIATION INDUCTION OF DOMINANT LETHALS AND OTHER CHANGES IN THE MOUSE. Liane B. Russell and W. L. Russell (Oak Ridge National Lab., Tenn.). Progr. Radiobiol., 187-92(1955).

5158

THE BIOCHEMICAL ASPECTS OF CHROMOSOME REJOINING. Sheldon Wolff and H. E. Luippold (Oak Ridge National Lab., Tenn.). Progr. Radiobiol., 217-21(1955).

5159

COMPARATIVE STUDY OF THE PHYSIOLOGICAL EFFECTS OF X-IRRADIATION AND RESISTANCE TO TRAUMATIC SHOCK. J. M. McKenna and B. W. Zweifach (New York Univ. -Bellevue Medical Center and Beth Israel Hospital, New York). Radiation Research 6, 126-36(1957) Feb.

5160

ACUTE X-RAY LETHALITY STUDIES WITH THE HAMSTER. THE LD_{50}, DEATH RATE, AND RECOVERY RATE. Henry I. Kohn and Robert F. Kallman (Univ. of California School of Medicine, San Francisco). Radiation Research 6, 137-47(1957) Feb.

5161

EFFECTS OF POSTIRRADIATION SURGICAL STRESS, ANESTHESIA, AND SPLEEN TRANSPLANTATION ON SURVIVAL OF MICE. Salvatore R. Restivo and Roy B. Mefferd, Jr. (Univ. of Texas, Austin). Radiation Research 6, 153-66(1957) Feb.

5162

THE RADIOSENSITIVITY OF SEEDS OF DIFFERENT ONTOGENETIC DEVELOPMENT. I. THE EFFECTS OF X-IRRADIATION ON OAT SEEDS OF DIFFERENT PHASES OF ONTOGENETIC DEVELOPMENT. Miloje R. Sarić (Institute for Plant Breeding and Plant Production, Zemun-Polje, Yugoslavia). Radiation Research 6, 167-72(1957) Feb.

5163

BIOLOGICAL EFFECTS OF FAST NEUTRONS FROM AN INTERNAL TARGET CYCLOTRON: PHYSICAL METHODS AND DOMINANT LETHALS IN DROSOPHILA. C. W. Sheppard, M. Slater, E. B. Darden, Jr., A. W. Kimball, G. J. Atta, C. W. Edington, and W. K. Baker (Oak Ridge National Lab., Tenn.). Radiation Research 6, 173-87 (1957) Feb.

5164

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF VARIOUS IONIZING RADIATIONS IN MAMMALIAN SYSTEMS. John B. Storer, Payne S. Harris, John E. Furchner, and Wright H. Langham (Los Alamos Scientific Lab., N. Mex.). Radiation Research 6, 188-288(1957) Feb.

5165

COMPARATIVE MORTALITY FOLLOWING SINGLE WHOLE BODY EXPOSURES OF MICE TO FISSION NEUTRONS AND Co^{60} GAMMA RAYS. Howard H. Vogel, John W. Clark, and Donn L. Jordan (Argonne National Lab., Lemont, Ill.). Radiology 68, 386-98(1957) March.

5166

THE ENERGY OF RADIATIONS AND SOME LAWS OF THEIR ACTION ON BIOLOGICAL OBJECTS. E. S. Shchepotyeva. Soviet J. Atomic Energy 4, 597-604(1956).

Modern views are presented on the primary physicochemical stage of the mechanism of the biological action of ionizing radiations and on certain laws of their action on biological objects, determined by the space and time distribution of the radiation energy in the organism. (auth)

5167
INVESTIGATION ON A BIOLOGICAL PROTECTIVE SCREEN. PART XVIII. THE EFFECT OF CENTRAL NERVOUS SYSTEM ON THE IRRADIATED ANIMAL. Hanns Langendorff and Ruprecht Koch. Strahlentherapie 102, 58-64(1957) Jan. (In German)

5168
EFFECT OF CYSTEINE ON THE RESULT OF THE RADIATION REACTION ON BONE MARROW AFTER LOCAL IRRADIATION. Helmut Hartweg. Strahlentherapie 102, 65-72(1957) Jan. (In German)

5169
REGENERATION OF X-RAY EXPOSED NERVES IN AMPHIBIAN LARVAE. Rita Stolz and Wolfgang Luther. Strahlentherapie 102, 73-7(1957) Jan. (In German)

5170
CELLULAR ASPECTS OF BASIC MECHANISMS IN RADIOBIOLOGY. Harvey M. Patt and E. L. Powers, eds. Washington, National Academy of Sciences—National Research Council. 1956. 196p.

Refer also to abstract 5247.

RADIATION HAZARDS AND PROTECTION

5171 AERE-HP/R-2182
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
RADIOSTRONTIUM AND RADIOCAESIUM MEASUREMENT IN BIOLOGICAL MATERIALS TO DECEMBER 1956. D. V. Booker, F. J. Bryant, A. C. Chamberlain, A. Morgan, and G. S. Spicer. 1957. 11p.

Data are presented on the Sr^{90} content of samples of soil, grass, milk, sheep bones, and human bones, and the Cs^{137} content of samples of milk collected in Great Britain during 1956. The trend of activity levels with time was examined, and it was found there was little increase in 1956 over 1955 except among samples derived from low calcium soil. (C.H.)

5172 CRC-689
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont, and Canada. Dept. of National Health and Welfare, Ottawa.
LEVELS OF STRONTIUM 90 IN CANADA UP TO DECEMBER 1956. Feb. 1957. 16p.

Data are summarized on the radiostrontium content of samples of milk and bone collected in Canada during 1956. Available information is included on fall-out in Canada and the amount of radioactivity on the ground. (C.H.)

5173
THE EFFECT OF OXYGEN CONCENTRATION ON THE DOSE-ACTION SURVIVAL CURVES OBTAINED FOR HABROBRACON EGGS IRRADIATED DURING MEIOTIC PROPHASE AND METAPHASE. Walter Kenworthy (Univ. of Pennsylvania, Philadelphia and Brown Univ., Providence, R. I.). Am Naturalist 90, 119-26(1956) March-April.

5174
THE RESPONSIBILITIES OF THE MEDICAL PROFESSION IN THE USE OF X-RAYS AND OTHER IONIZING RADIATION. STATEMENT BY THE UNITED NATIONS SCIENTIFIC COMMITTEE ON THE EFFECTS OF ATOMIC RADIATION. J. Nat. Cancer Inst. 18, 481-5(1957) March.

5175
A CASE OF ACCIDENTAL PUNCTURE CONTAMINATED WITH Th^{227}. P. F. Gustafson, L. D. Marinelli, and E. A. Hathaway (Argonne National Lab., Lemont Ill.). Radiology 68, 358-66(1957) March.

As a result of an accidental puncture with forceps contaminated with $Th^{227}Cl_4$, a few microcuries of the element gained interior access to the body of a laboratory worker, a woman thirty-five years of age. Clinical management and radioactivity studies instituted are described in details. (auth)

5176
INVESTIGATION ON A BIOLOGICAL PROTECTIVE SCREEN. XVII. THE EFFECT ON RADIATION PROTECTION OF CYSTEAMINE ADMINISTERED AFTER PARTIAL BODY IRRADIATION. Hanns Langendorff, Alexander Catsch, and Ruprecht Koch. Strahlentherapie 102, 51-7(1957) Jan. (In German)

Cysteamine administered to rats within the first 24 hours after a partial irradiation entails a reduction of the 30-days-mortality. The protective effect can be observed only in the range of medium ray doses and is less distinct than in an irradiation preceded by cysteamine treatment. The combined application of cysteamine and liver homogenate or liver hydrolysate respectively, has no effect. A proved explanation of the observed effect cannot yet be given. (auth)

RADIATION SICKNESS

5177
NEW DRUGS FOR IRRADIATION SICKNESS. Basil A. Stoll (Peter MacCallum Clinic, Melbourne, Australia). Radiology 68, 380-5(1957) March.

RADIOTHERAPY

5178
TREATMENT OF HYPERTHYROIDISM WITH INDIVIDUALLY CALCULATED DOSES OF I^{131}. Franz K. Bauer and William H. Blahd. Arch. Internal Med. 99, 194-201 (1957) Feb.

TOXICOLOGY STUDIES

5179 AECU-3261
Massachusetts Inst. of Tech., Cambridge. Radioactivity Center.
RADIUM AND MESOTHORIUM POISONING AND DOSIMETRY AND INSTRUMENTATION TECHNIQUES IN APPLIED RADIOACTIVITY. Annual Progress Report. May 1956. 100p. Contract AT(30-1)-952. $0.55(OTS).

TRACER APPLICATIONS

5180 UR-485
Rochester, N. Y. Univ. Atomic Energy Project.
USE OF UREA AND SALICYLATE TO ELUTE ANTIBODY FROM INSOLUBLE ANTIGEN. Irving L. Spar, William F. Bale, and Ruth L. Goodland. Feb. 18, 1957. 18p. Contract W-7401-eng-49. $3.30(ph OTS); $2.40(mf OTS).

5181
RADIOIODINE CONTENT OF AQUEOUS, VITREOUS, AND LENS. Irving Shapiro, Clifford W. Gurney, and Arthur J. Solari. Arch. Ophthalmol. (Chicago) 57, 430-4(1957) March.

5182
EVALUATION OF TRITIUM CHOLESTEROL AS A TRACER IN MAN. Harold Werbin, Delbert M. Bergenstal, R. Gordon Gould, and George V. LeRoy (Argonne Cancer Research Hospital, Chicago; Univ. of Chicago, Ill.; and Los Alamos Scientific Lab., N. Mex.). J. Clin. Endocrinol. and Metabolism 17, 337-45(1957) March.

5183

C^{14}-FORMATE METABOLISM BY ISOLATED TISSUES FROM X-IRRADIATED RATS. D. A. Rappoport, R. A. Seibert, and V. P. Collins (Baylor Univ. Coll. of Medicine, Houston, Texas). Radiation Research 6, 148-52(1957) Feb.

CHEMISTRY

5184 AECU-3161

Michigan. Univ., Ann Arbor. Engineering Research Inst.

STUDY OF THE FEASIBILITY OF AQUEOUS RECOVERY OF SPENT FUELS. PART 2. PROPERTIES OF MATERIALS UNDERGOING CHEMICAL PROCESSING. Joseph J. Bulmer, H. A. Ohlgren, and J. G. Lewis. June 1954. 46p. Project 2240. (ERI-2240-2-F).

Work done for Dow Chemical-Detroit Edison and Associates, Atomic-Power Development Project at request of Consumers Power Co. (Jackson County). $0.35(OTS).

5185 AECU-3429

Syracuse Univ., N. Y. Research Inst.

DETONATION PRESSURES OF STOICHIOMETRIC HYDROGEN–OXYGEN MIXTURES SATURATED WITH WATER AT HIGH INITIAL TEMPERATURES AND PRESSURES. Final Report. Paul Lewis McGill and James A. Luker. Dec. 3, 1956. 105p. For [Oak Ridge National Lab.] Contract W-7405-eng-26, Subcontract No. 548. (SURI-Ch.E.-273-5611F). $16.80(ph OTS); $5.70(mf OTS).

Measurements were made at temperatures of 25, 150, and 200°C with atmospheric pressures from 1 to 60. The reflected wave pressure measurements obtained were ~25 to 84% of the theoretical values. The high-pressure equipment used for the tests are described. (W.L.H.)

5186 AERE-C/R-1567

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN ELECTRO-CAPILLARY VALVE FOR CONTROLLING THE FLOW OF MERCURY TO A MERCURY DROP ELECTRODE. G. C. Barker. Dec. 12, 1954. 12p.

An electro-capillary valve which can deliver a definite volume of Hg by application of a voltage pulse is described. Its use as a dropping Hg electrode is discussed. (T.R.H.)

5187 AERE-CE/M-24

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].

A PROPOSED LIQUID EXTRACTION DEVICE USING A CENTRIFUGAL FIELD. S. G. Bauer. Mar. 16, 1951. Decl. Dec. 13, 1956. 4p.

5188 CCC-1024-TR-227

Callery Chemical Co., Penna.

SCREENING EXPERIMENTS OF METHYLBORATE WITH VARIOUS CHLORIDES. R. K. Pearson, T. W. Platt, J. C. Renforth, N. J. Sheetz, and L. J. Edwards — L. S. Stone, ed. Mar. 1, 1957. 8p. Contract [NOa(s)-52-1024-c].

Dimethoxychloroborane was produced from methyl borate and carbon tetrachloride, silicon tetrachloride, phosphorus trichloride, phosgene, or sulfuryl chloride in a series of screening experiments. Excess chlorine apparently converted methyl borate quantitatively to boron trichloride. Treatment of methyl borate with HCl, $HgCl_2$, $FeCl_3$, $AsCl_3$, $SnCl_4$, phosphorus oxychloride, sulfur chloride, thionyl chloride, ammonium chloride, and dimethyldichlorosilane yielded methyl chloride instead of products containing boron-chlorine bonds. A method for detecting chlorodimethoxyborane by infrared spectroscopy was developed. (auth)

5189 HEC-74

Hooker Electrochemical Co., Niagara Falls, N. Y.

QUARTERLY REPORT FOR OCTOBER, NOVEMBER AND DECEMBER 1956. George T. Miller. Dec. 31, 1956. 14p. Contract AT(30-1)-1524. $3.30(ph OTS); $2.40 (mf OTS).

The anisole–BF_3 system for isotope separation was shut down. The dimethyl ether–BF_3 system producing B^{11} on a pilot plant scale has been successfully operated. A study is being conducted on the corrosion of various metals by anisole–BF_3 complex at elevated temperatures. The preparation of KBF_4 enriched in B^{11} was carried out in the laboratory to avoid contamination with B^{10}. (W.L.H.)

5190 NP-6232

Mine Safety Appliances Co., Callery, Penna.

IN-PILE TESTING OF MONO-ISOPROPYL BIPHENYL. Technical Report No. 55. M. J. McGoff and J. W. Maustellar. Feb. 28, 1957. 34p. Contract NObs-65426.

Mono-isopropyl-biphenyl (MIPB) was circulated at 600°F through a loop in the Brookhaven reactor and investigated for stability in a fast flux of 1.6×10^{11} neutrons/cm^2-sec. The average specific decomposition of MIPB was ~3% per 10^{17} NVT fast flux (>1.6 mev) and compares favorably with the damage rate reported for biphenyl. The gassing rate of MIPB was 15 to 20 ml STP/g of decomposition product being higher than biphenyl by ~ 50%. Hydrogen and methane were the principle decomposition gases. No fouling of heat transfer surfaces was observed. Activity level of the MIPB after 175 days exposure was 0.02 μc/g, starting from 0.10 μc/g: 50% of the initial activity was Cl^{38} (auth)

5191 AEC-tr-2834

COMPLEX FORMATION IN BINARY FUSED SALTS. L. N. Antipin. Translated from Uspekhi Khim. 25, 632-42 (1956). 17p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 11-96. (T.R.H.)

5192 AEC-tr-2848

ELECTRICAL CURRENT CAUSED BY FIXED DIFFERENCES IN CONCENTRATION ON EACH SIDE OF A MEMBRANE. P. Hirsch-Ayalon. Translated by K. S. Bevis from Chem. Weekblad 52, 557-9(1956). 4p.

A membrane of cellophane with $BaSO_4$ precipitated in it is placed between H_2SO_4 and $Ba(OH)_2$. The resulting high membrane potential can produce a steady electric current of high current density. (T.R.H.)

5193 AEC-tr-2853

INVESTIGATION OF THE INFLUENCE OF DIFFUSED HYDROGEN ON THE POTENTIAL OF IRON IN ALKALI SOLUTIONS. I. A. Bagotskaya. Translated from Doklady Akad. Nauk S.S.S.R. 107, 843-6(1956). 6p.

Experiments were performed to investigate the influence of diffused atomic H_2 on the Fe potential in a 5N NaOH solution. (W.L.H.)

5194 AEC-tr-2863

ELECTROMOTIVE FORCES OF THERMOCHAINS OF FUSED SALTS. B. F. Markov. Translated by J. M. Crabtree from Doklady Akad. Nauk S.S.S.R. 108, 115-17 (1956). 5p.

The electromotive forces of thermochains of fused Ag halides in the pure state and in mixtures with the alkali metal halides were measured. (W.L.H.)

5195 AEC-tr-2866

REACTION BETWEEN KOJIC ACID AND SCHIFF'S BASES. R. Barchielli. Translated from Ann. chim. appl. 30, 473-5 (1940). 4p.

Kojic acid was made to react with benzilideine and toluidenaniline, and condensation products were obtained

similar to those resulting from the action of naphthols and indoles on Schiff's bases. (auth)

5196

GENERALIZED ACIDITY IN RADIOCHEMICAL SEPARATIONS. Ralph A. Horne and Charles D. Coryell (Massachusetts Inst. of Tech., Cambridge) and Lionel S. Goldring (Nuclear Development Corp. of America, White Plains, N. Y.). Ann. Rev. Nuclear Sci. 6, 163-78(1956).

84 references.

5197

APPLICATIONS OF OXYGEN ISOTOPES IN CHEMICAL STUDIES. Henry Taube (Univ. of Chicago, Ill.). Ann. Rev. Nuclear Sci. 6, 277-302(1956).

The application of oxygen isotopes to the study of chemical phenomena in homogeneous solution is reviewed. The research techniques that have been employed are described. The results of the more important investigations involving the use of oxygen isotopes are summarized. 177 references. (T.R.H.)

5198

THE THERMAL DECOMPOSITION OF AQUEOUS CHROMIC ACID AND SOME PROPERTIES OF THE RESULTING SOLID PHASES. B. J. Thamer, R. M. Douglass, and E. Staritzky (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 79, 547-50(1957) Feb. 5.

Aqueous chromic acid solutions in closed containers evolve O_2 at an appreciable rate at 300 to 325°. The equilibrium has been investigated at O_2 pressures between 50 and 200 atmospheres. The decomposition is first order at 300° but it is approximately of order 1½ at 325°. The solid decomposition products are chromium dioxide (cassiterite structure, $a_0 = 4.421 \pm 0.002$ A, $c_0 = 2.916 \pm 0.001$ A) and $HCrO_2$ (diffraction symbol $\bar{3}mR$---, $a_0 = 4.787 \pm 0.005$ A, $\alpha = 36.3 \pm 0.1°$, Z = 1). (auth)

5199

DECOMPOSITION OF ETHYLENE IN AN ELECTRIC DISCHARGE. M. Prakasa Reddy and Milton Burton (Univ. of Notre Dame, Ind.). J. Am. Chem. Soc. 79, 813-20(1957).

The effects of an atmospheric pressure electric discharge on C_2H_4 as well as on mixtures of C_2H_4 with H_2, D_2, H_2 plus D_2, C_2H_2, C_2D_2 and C_2D_4, respectively, have been studied. The products formed are compared with those produced from low pressure discharge through C_2H_4 as well as with those formed by bombardment with 1.5 Mev. electrons. The rate dependence of the over-all reaction $C_2H_4 \rightarrow C_2H_2$, etc., in the atmospheric pressure discharge through pure C_2H_4, is first-order in C_2H_4 and apparently half order in current. Carbon production is suppressed by initial admixture of H_2 or D_2. The reaction appears to proceed by successive removal of H atoms (not of a single H_2 molecule in an elementary process). The calculated average energy of the electrons is of the order of 1 e.v. and it is suggested that a successive excitation mechanism is required to maintain the discharge. The half-order dependence on current may be an artifact resultant from the fact that in an unconstricted discharge the current density tends to remain constant. It is shown that a kinetic scheme which depends on Stern-Volmer reactions of excited C_2H_2 appears to afford the most satisfactory interpretation of the totality of the results. (auth)

5200

GRAPHITE COMPOUNDS. Marceline L. Dzurus and Gerhart R. Hennig (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 79, 1051-4(1957) March 5.

Most lamellar compounds of graphite are definitely ionic. Some conceivable exceptions to this rule appeared to be the lamellar graphite compounds with aluminum chloride. Therefore, these have been investigated in detail. It has been found that, besides aluminum chloride and graphite, a third substance capable of forming negative ions had to be present for reaction to occur. Hence these compounds are also ionic. Electrical measurements have shown that all the compounds examined are P-type and have the approximate compositions $C_n^+Cl^- \cdot 3AlCl_3$, $C_n^+Br^- \cdot 3AlCl_3$, $C_n^+I^- \cdot 3AlCl_3$, $C_n^+Cl^- \cdot FeCl_2 \cdot 3AlCl_3$ and $C_n^+Cl^- \cdot FeCl_2 \cdot 3FeCl_3$, where n can vary between about 30 and infinity. (auth)

5201

THE EFFECT OF NITRATE ION ON THE YIELD OF HYDROGEN FROM WATER RADIOLYSIS. R. G. Sowden (Atomic Energy Research Establishment, Harwell, Didcot, Berks). J. Am. Chem. Soc. 79, 1263-4(1957). March 5.

Solutions of $Ca(NO_3)_2$ were irradiated in the mixed fast neutron-γ flux of BEPO at a temperature of ~80°C. The NO_3^- concentration was varied from ~15.9 to 0.03 M. The results may be interpreted in terms of "capture" of H atoms by NO_3^- ($NO_3^- + H \rightarrow NO_2 + OH^-$). (W.L.H.)

5202

THE SOLUBILITY AND ENTROPY OF SOLUTION OF ARGON IN FIVE SELECTED NON-POLAR SOLVENTS. L. W. Reeves and J. H. Hildebrand (Univ. of California, Berkeley). J. Am. Chem. Soc. 79, 1313-14(1957) March 20.

The solubility of A in five non-polar solvents with different solubility parameters has been measured over a sufficient temperature range to yield reliable values of the entropy of solution at 1 atm. and 25° are as follows: $CeF_{11}CF_3$, 0.4600, −1.5; $C_6H_{11}CH_3$, 0.1855, −0.9; CCl_4, 0.134, −0.5; $C_6H_5CH_3$, 0.1095, +0.4; CS_2, 0.0487, +1.8. For the entropy of dissolving argon at 1 atm. and 25° into its solutions at the the same mole %, 0.0100, the respective figures are 6.1, 4.8, 4.7, 5.15 and 5.0. They vary much more widely when calculated to equal volume concentration. The variation of solubility with temperature depends mainly upon the dilution necessary to balance the effects of intermolecular forces. (auth)

5203

FURTHER REMARKS ON THE HYDRATES OF THORIUM TETRAFLUORIDE. R. W. M. D'Eye and G. W. Booth (Atomic Energy Research Establishment, Harwell, Didcot, Berks). J. Inorg. and Nuclear Chem. 4, 13-21(1957) Feb.

The preparation of $ThF_4.xH_2O$ (x = 2.5−3.0) and $Th_4.yH_2O$ (y = 0.5−2.0) has been reinvestigated and further work on the degradation of these hydrates has been carried out. Three further hydrates have been prepared by the reaction of steam or water with anhydrous ThF_4. X-ray crystallographic data are given for these hydrates. (auth)

5204

DECONTAMINATION OF PROCESSING PLANTS. G. S. Sadowski (Oak Ridge National Lab., Tenn.). Nucleonics 15, No. 3, 68-72(1957) March.

The decontamination of reactor-fuel processing plants for emergency repair, for shutdown prior to preventive maintenance, shutdown prior to changing feed in multipurpose plants, and safe working levels are discussed. The Thorex and Purex Process flowsheets are included. (W.L.H.)

5205

INVESTIGATION OF SYSTEMS OF FUSED SALTS BASED ON THORIUM FLUORIDE. V. S. Emelyanov and A. I. Evstyukhin. Soviet J. Atomic Energy 4, 561-6(1956).

The system ThF_4−NaCl−KCl, which is significant in the selection of an electrolyte for the production of thorium by electrolysis, was investigated by thermal and x-ray phase-analytical methods. The salts were melted in an atmosphere of argon. The following structural diagrams were constructed: the system NaCl−ThF_4−an eutectic type with complete insolubility in the solid state (the eutectic lies at 712°C and 52 mole % ThF_4); the system KCl−ThF_4−the same type (eutectic at 704°C and 23 mole % ThF_4); and a

section of the ternary system NaCl–KCl–ThF_4 along the line (1NaCl: 1KCl)–ThF_4 with the point of intersection with the eutectic crystallization curve at 626°C and 40% (by weight) ThF_4. (auth)

ANALYTICAL PROCEDURES

5206 A-2912(Vol.II, Pt.2)
Madison Square Area, Manhattan District, New York.
MANUAL OF ANALYTICAL METHODS. VOLUME II. PART 2. ANALYSIS OF REFINED MATERIALS AND BY-PRODUCTS. Lewis G. Bassett, Daniel J. Pflaum, Robert J. Rutman, Clement J. Rodden, and N. H. Furman, comps. Jan. 1946. Decl. June 21, 1956. 119p. $0.60(OTS).

Methods for determining Fe, Mn, Mo, P, SiO_2 (silica), S, P, V, HNO_3, H_2S, $(NH_4)_2CO_3$, Pt elements, and rare earths in uranium oxides, leach solutions, tails, cakes, and by-products of U refining are given. (T.R.H.)

5207 AERE-C/M-180
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
DETERMINATION OF FREE ACID IN THE PRESENCE OF THORIUM. B. A. Loveridge. July 1953. Decl. Nov. 22, 1956. 7p.

A method is described for the determination of free acid or base in the presence of Th^{4+}. The Th is precipitated with a stoichiometric quantity of F^- and then the solution is titrated for acid or base using a conductometric endpoint. This analysis works successfully where the acid to Th ratio is considerably less than 1:1 and as little as 0.03 millimoles of free acid may be detected. (auth)

5208 AERE-C/M-218
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
ANALYSIS OF SAMPLE OF CRUDE THORIUM HYDROXIDE SLUDGE. F. W. Cornish and A. Thomas. Dec. 3, 1954. 8p.

Methods are presented for the determination of Th and rare earths in monazite sand. (W.L.H.)

5209 AERE-C/R-1404
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
SQUARE WAVE POLAROGRAPHY. PART II. NOTES ON THE USE OF THE SQUARE WAVE POLAROGRAPH. G. C. Barker and D. R. Cockbaine. Dec. 3, 1954. Decl. Jan. 23, 1957. 27p.

5210 AWRE-O-39/56
Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
THE APPLICATION OF MICRO-CHEMICAL METHODS TO RADIOCHEMICAL ANALYSIS. J. Herrington and R. G. Monk. Oct. 5, 1956. 58p.

5211 CCC-1024-TR-226
Richmond, Va. Univ.
CARMINIC ACID METHOD FOR SPECTROPHOTOMETRIC DETERMINATION OF BORON. W. A. Powell and E. H. Poindexter. Feb. 20, 1957. 26p. [For Callery Chemical Co. Contract NOa(s)-52-1024-c].

The use of carminic acid for the spectrophotometric determination of up to 40 μg of B has the advantages of sensitivity, reproducibility (± 2%), and simplicity. Strong oxidizing agents, highly charged cations, and anions that form strong complexes with B are the only ions that interfere seriously. Results of several variable studies led to increased knowledge of and improvements in the carminic acid method. Change in the concentration of water has little effect, and the presence of 2 ml of water is desirable. The reagent solution may be stored either in light or dark; absorbance changes with age of the reagent solution, but the slope of the calibration curve does not change appreciably. Standardization of the reagent more often than once a week is not necessary when the blank solution is used to set the zero of the spectrophotometer. (auth)

5212 CF-56-12-111
Oak Ridge National Lab., Tenn.
SPECTROPHOTOMETRIC DETERMINATION OF LITHIUM CARBIDE IN METALLIC LITHIUM AS THE ACETYLENE–SILVER PERCHLORATE COMPLEX. T. W. Gilbert, Jr., A. S. Meyer, Jr., and J. C. White. Dec. 27, 1956. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); OTS); $1.80(mf OTS).

Lithium carbide and Li_3N in Li metal are determined simultaneously by measuring the quantities of acetylene and ammonia that are evolved when a sample of Li is dissolved in water. Ammonia is absorbed in a solution of BH_3 and is determined by the conventional Nessler's method. Available methods for the determination of small amounts of acetylene either lacked the required sensitivity or were not suited to this application. Accordingly, a new spectrophotometric method was devised for the determination of 50 to 2500 μg of acetylene with a coefficient of variation of 2.7%. The acetylene is absorbed in 1.5 M silver perchlorate; the ultraviolet absorption of the soluble silver-acetylene complex that is formed is then utilized for the determination of acetylene. (auth)

5213 HW-40801(Rev.)
[General Electric Co. Hanford Atomic Products Operation, Richland, Wash.]
COMPARISON OF FLAME PHOTOMETER AND CONDUCTIVITY METER FOR THE DETERMINATION OF NaCl FROM RESPIRATOR TESTING. J. W. Baum and W. E. Gill. Sept. 26, 1955. 8p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Results are presented from a comparison of the relative merits of the flame photometer and conductivity meter for the determination of NaCl in filters. (C.H.)

5214 IGO-AM/W-68
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE DETERMINATION OF THE PLUTONIUM CONTENT OF URINE (PHOSPHATE METHOD). G. P. Cook and O. Jones. Sept. 19, 1952. Reissued Jan. 9, 1957. 6p.

5215 IGO-AM/W-70
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE DETERMINATION OF RADIO-RUTHENIUM IN SEAWEED ASH. J. Barraclough. Feb. 8, 1957. 5p.

The Ru is oxidized by fusion with KNO_3 and KOH, extracted into CCl_4, precipitated as RuO_2, and the activity measured with standard counting equipment. (auth)

5216 IGO-AM/W-78
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE DETERMINATION OF TRACE AMOUNTS OF OIL IN CARBON DIOXIDE BY ABSORPTION IN CARBON TETRACHLORIDE AND INFRA RED SPECTROMETRY. E. Hughes. Mar. 7, 1957. 3p.

5217 Y-1153
Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
THE DETERMINATION OF MOLYBDENUM IN URANIUM–MOLYBDENUM ALLOYS BY MONOCHROMATIC X-RAY ABSORPTION. William C. Dietrich and Roscoe E. Barringer. Feb. 21, 1957. 14p. Contract W-7405-eng-26. $0.20(OTS).

A rapid method is described for the determination of 2 – 5% Mo in Mo–U alloys. The method consists of a mono-

chromatic x-ray absorption analysis for Mo after the major portion of U has been removed by a tributyl phosphate extraction. The limit of error for a single determination at a 95% confidence level is ± 2.7% of the Mo present. (auth)

5218

SPECTROPHOTOMETRIC DETERMINATION OF BERYLLIUM WITH ERIOCHROME CYANINE R. Shunji Umemoto (Okayama Univ.). Bull. Chem. Soc. Japan 29, 845-52(1956) Nov.

5219

ESTIMATION OF FREE NITRIC ACID IN URANYL NITRATE BY ION EXCHANGE. D. V. Bhatnagar (Atomic Energy Establishment, Bombay). J. Sci. Ind. Research (India) 16B, 23-5(1957) Jan.

A simple, accurate and quantitative method has been developed for the determination of the free acid in an aqueous solution of $UO_2(NO_3)_2$. The test solution is passed through a column of the cation exchanger, Amberlite IR-120(H), and after washing with water the effluent containing the free acid, present in the test solution, together with the acid liberated from the resin bed by exchange of the UO_2^{2+} for the H^+ of the resin, is titrated against standard alkali; a sensitive pH meter is used to detect the end point. The free acid is found by deducting from the total acid, the acid equivalent to the UO_2^{2+} in the influent. For this purpose U is determined accurately in an aliquot of the sample solution. The entire estimation takes about 2 hr. (auth)

5220

AN ION-EXCHANGE METHOD OF ESTIMATING CARBONATE IN THE PRESENCE OF URANIUM & VANADIUM. A. K. Sundaram, M. Sundaresan, and D. G. Vartak (Atomic Energy Establishment, Bombay). J. Sci. Ind. Research (India) 16B, 25-7(1957) Jan.

A method is described for the estimation of Na_2CO_3 in the presence of U and V by ion exchange using Amberlite IRA-400 (CO_3^{--}). Amounts as small as 20 mg. of Na_2CO_3 in the presence of 8 mg. of U and 10 mg. of V can be estimated within an error of 2%. (auth)

5221

THE SPECTROGRAPHIC ESTIMATION OF SUB-MICROGRAM QUANTITIES OF BERYLLIUM BY THE CATHODE LAYER TECHNIQUE. F. T. Birks (Atomic Energy Research Establishment, Harwell). Spectrochim. Acta 7, 231-7(1955).

0.02 milligamma (2.0×10^{-11} gram) of Be is estimated by the cathode layer technique, using a quartz Littrow spectrograph, while 0.01 mμg is detected if the line contour of Be 2348.61 and of the background structure is traced by means of a recording microphotometer. Fe 2348.30 and 2348.10 interfere if present in large amount, but 0.05 mμg of Be is detected in the presence of 50 micrograms of iron. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5222 AD-61182

North Carolina State Coll., Raleigh.

THE STRUCTURE OF ELECTRODEPOSITED NICKEL (thesis). Russell Wayne Bollinger. 1955. 32p.

The structure of electrodeposited Ni was investigated and determined to be face-centered cubic. Two out of ninety-nine specimens exhibited a weak close-packed hexagonal modification, which disappeared after being exposed to atmospheric conditions for a few days. It is possible to form an unstable hydride, containing hydrogen atoms in interstitial spaces, under some conditions. The instances where a close-packed hexagonal modification seems to exist should be interpreted as resulting from unstable interstitial compounds, and not a polymorphic modification of nickel. (auth)

5223 WAPD-T-208

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

THE CRYSTAL STRUCTURE OF U_2Mo. E. K. Halteman. Sept. 1955. 10p. $1.80(ph OTS); $1.80(mf OTS).

The crystal structure of the gamma prime phase in the U–Mo system has been determined to be the C11b $MoSi_2$ type. The unit cell is tetragonal and the space group D_{4h}^{17}–I4/mmm. The lattice parameters are $a_0 = 3.427$A, $c_0 = 9.834$A, $c/a = 2.871$. The gamma phase is an ordered state of the body-centered cubic gamma phase. (auth)

Refer also to abstract 5328.

DEUTERIUM AND DEUTERIUM COMPOUNDS

5224

THE EQUILIBRIUM DISTRIBUTION OF LIGHT AND HEAVY WATERS IN A FREEZING MIXTURE. John C. Posey and Hilton A. Smith (Univ. of Tennessee, Knoxville). J. Am. Chem. Soc. 79, 555-7(1957) Feb. 5.

The equilibrium distribution of the deuterium content of a mixture of light and heavy water between the solid and liquid phases has been determined. The deuterium concentrates in the ice phase. The separation factor, α, in solutions containing approximately 18 mol.% of the total hydrogen as deuterium was found to be 1.0211 ± 0.0007. (auth)

5225

A COMPARISON OF THE RADIOLYSIS AND MASS SPECTROMETRY OF SEVERAL DEUTERATED ETHANOLS. John C. Burr, Jr. (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 79, 751-2(1957) Feb. 5.

5226

VAPOR PRESSURE STUDIES INVOLVING SOLUTIONS IN LIGHT AND HEAVY WATERS. III. THE SEPARATION FACTOR FOR THE ISOTOPES OF HYDROGEN DURING DISTILLATION FROM SALT SOLUTIONS IN THE MIXED WATERS AT ROOM TEMPERATURE. John M. Googin and Hilton A. Smith (Univ. of Tennessee, Knoxville). J. Phys. Chem. 61, 345-50(1957) March.

An investigation has been made into the possibility of changing the separation factor for the fractionation of the isotopes of hydrogen during the distillation of water by the addition of various solutes to the system. The experimental procedure involved the direct determination of the separation factor for the system under study by analysis of the two phases at equilibrium, rather than carrying out experiments on solutions in the pure waters and attempting subsequent predictions which could be in serious error. The results indicate that there is little possibility of improving the separation by additions to the water phase at room temperature. Apparently anything which is added to water disrupts its structure to some extent and thus reduces the separation factor. This reduction in the separation factor amounts to more than 60% of its excess over one when zinc iodide is used as solute. (auth)

5227

APPARATUS FOR STANDARD MEASUREMENT OF THE ISOTOPIC EXCHANGE OF DEUTERIUM BETWEEN HYDROGEN AND WATER AT ATMOSPHERIC PRESSURE AND 100°C. M. Silvestri and N. Adorni (Lab. CISE, Milano). Nuovo cimento (10) 5, 266-74(1957) Jan. (In Italian)

An apparatus for the measurement of the isotopic exchange of deuterium between hydrogen and water vapor is described. It is particularly arranged for catalyst life tests. Precautions were taken in order to prevent contami-

nation of the gas and of the water, and some constructive devices were chosen in order to obtain safety and to avoid continuous watching. Measurements of the deuterium concentration in hydrogen can be made in two ways: by thermal conductivity directly on the gas, or by a float method on the water obtained by combustion of hydrogen with oxygen. The fraction of conversion (β) is chosen as the measure of operational efficiency of the catalyst. Accuracy on β is of the order of ±5%. (auth)

5228

THE ANALYSIS OF HEAVY WATER BY INFRA-RED SPECTROMETRY. J. Gaunt (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Spectrochim. Acta 8, 57-65(1956).

Methods are described for the analysis of the D_2 content of D_2O in the concentration ranges 50% D_2O, 3% D_2O, 0.2% D_2O, and the natural range. The accuracy of determination rises from ±2% in the natural range to ±0.05% in the 50% range. The measurements are made directly on the samples without any previous dilution or enrichment, and in consequence the methods developed are suitable for application to continuously flowing plant streams. Instrumentation for the laboratory and the plant is discussed. (auth)

Refer also to abstract 5281.

FLUORINE AND FLUORINE COMPOUNDS

5229

CHEMICAL EQUILIBRIA IN THE GASEOUS SYSTEM BROMINE–BROMINE TRIFLUORIDE–BROMINE MONOFLUORIDE. Robert K. Steunenberg, Richard C. Vogel, and Jack Fischer (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 79, 1320-3(1957) March 20.

Equilibrium constants were determined for the gas-phase reaction $BrF_3 + Br_2 \rightleftharpoons 3BrF$. The extent of the reaction was derived from manometric measurements at constant volume and the absorption spectra of the mixtures. Equilibrium constants obtained at different temperatures were used to calculate the standard free energy and enthalpy of formation of BF_3. (auth)

5230

VAPOR PRESSURE AND DERIVED INFORMATION OF THE SODIUM FLUORIDE–ZIRCONIUM FLUORIDE SYSTEM. DESCRIPTION OF A METHOD FOR THE DETERMINATION OF MOLECULAR COMPLEXES PRESENT IN THE VAPOR PHASE. Karl A. Sense, C. A. Alexander, R. E. Bowman, and R. B. Filbert, Jr. (Battelle Memorial Inst., Columbus, Ohio). J. Phys. Chem. 61, 337-44(1957) March.

By use of the transpiration method, the vapor pressures of the $NaF–ZrF_4$ system were measured over the range 599 to 1075°C. A partial phase diagram of the $NaF–ZrF_4$ system derived from the vapor pressure data shows a constant boiling point to exist at 25 mole % ZrF_4. Plots showing vapor–liquid–solid equilibria are presented. A plot is given showing the change of the total vapor pressure of the $NaF–ZrF_4$ system with composition for various temperatures. (auth)

5231

THE CHLORINE TRIFLUORIDE–HYDROGEN FLUORIDE SYSTEM. SOME VAPOR PRESSURE AND CONDUCTANCE MEASUREMENTS. Max T. Rogers, John L. Speirs, and Morton B. Panish (Michigan State Univ., East Lansing). J. Phys. Chem. 61, 366(1957) March.

5232

THE VAPOR PRESSURE OF SODIUM FLUORIDE. Karl A. Sense, C. A. Alexander, R. E. Bowman, R. W. Stone, and R. B. Filbert, Jr. (Battelle Memorial Inst., Columbus, Ohio). J. Phys. Chem. 61, 384(1957) March.

GRAPHITE

5233 AERE-N/PC-14

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

VARIATION OF GRAPHITE DAMAGE IN A HOLLOW SLUG AND IN A GRAPHITE BLOCK. G. H. Kinchin. Aug. 18, 1950.

The graphite damage is shown to be 3.2 times greater inside a hollow slug than just outside the slug and the variation of damage over a unit cell of the lattice in BEPO is determined. In both cases electrical resistivity was used to assess the damage. (auth)

5234

SURFACE PROPERTIES OF IRRADIATED GRAPHITE. C. N. Spalaris, L. P. Bupp, and E. C. Gilbert (General Electric Co., Richland, Wash. and Oregon State Coll., Corvallis). J. Phys. Chem. 61, 350-4(1957) March.

The surface characteristics of neutron irradiated graphite have been investigated. Studies include measurements of surface area, density, heat of adsorption and pore size distribution. The results obtained indicate that the magnitude of these properties decreases with increasing irradiation exposures. It has been proposed that the graphite crystallites in expanding upon neutron irradiation, occupy the voids in their immediate vicinity, thus causing the changes in surface properties. (auth)

5235

GRAPHITE AND MOLYBDENUM DISULPHIDE. E. R. Braithwaite (Acheson Colloids Ltd.). Nuclear Eng. 2, 107-10(1957) March.

The lubricating properties of graphite and MoS_2 are compared and discussed. The lubricity of graphite depends on the presence of an adsorbable vapor. How previous history of MoS_2 affects its frictional behavior is discussed. (T.R.H.)

LABORATORIES AND EQUIPMENT

5236 AERE-C/M-150

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A DOUBLE GLOVEBOX SYSTEM FOR USE WITH α-EMITTERS. C. J. Mandleberg. July 29, 1952. Decl. Nov. 22, 1956. 8p.

A double walled glovebox is described which can be used for handling α emitters when operation of the normal type of box would be too hazardous. Special techniques of glove changing and introduction of liquid oxygen into such a box are also described. (auth)

5237 AERE-E/M-65

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A SIPHON STARTING DEVICE. H. W. Marsden. Dec. 11, 1952. Decl. Jan. 23, 1957. 4p.

5238 PA-TR-2371

Picatinny Arsenal. Samuel Feltman Ammunition Labs., Dover, N. J.

SIMPLE CONVERSION OF AN ANALYTICAL BALANCE FOR AUTOMATICALLY RECORDING WEIGHT CHANGES. Clement Campbell and Saul Gordon. Oct. 1956. 16p. DA Project 504-01-027. (AD-112231).

A simple conversion of an analytical balance for the continuous automatic recording of weight changes is de-

scribed. No balance alterations are required. It is based on the hydrostatic principle that changes in the amount of a liquid displaced by a rod suspended into it from one end of a balance beam are proportional to the change in weight of a sample suspended from the other end of the beam. A linear variable differential transformer is used to electronically measure and record the beam deflections, and thus the changes in weight. By using rods of various diameters and liquids of various densities, the sensitivity of the balance can be varied, over ranges of micrograms to grams. (auth)

5239 AFC-tr-2827

THE RC-TITRATION. A NEW METHOD FOR ELECTRODELESS CONDUCTIVITY MEASUREMENT. R. Huber and K. Cruse. Translated by E. Wait from Angew. Chem. 68, 178-81(1956). 6p.

The theoretical basis of a method by which conductivities can be measured over a practically unlimited range is discussed. An electrodeless cell normally employed in high frequency titrations is used as one arm of a Wien bridge in an RC generation. Significant aspects of apparatus, construction and practical measurement are discussed. (auth)

RADIATION CHEMISTRY

5240

THE RADIATION CHEMISTRY OF FERROUS CHLORIDE SOLUTIONS. Harold A. Schwarz (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 79, 534-6(1957) Feb. 5.

The radiation induced oxidation of Fe^{2+} in air-saturated 0.4 M HCl differs from the oxidation in 0.4 M H_2SO_4 in that the Fe^{2+} production is not linear with dose. The initial yield is essentially the same, $G_{(Fe III)}$ (ions oxidized per 100 e.v. absorbed) being 15.8, but the kinetics indicate a competition between Fe^{2+} and O_2 for H atoms. The effect of the competition is to decrease the yield, and the effect increases with increasing Cl^- concentration. The ratios of the rate constant for H atoms reacting with Fe^{2+} and O_2 at the various Cl^- concentrations have been separated into the ratios for the individual species present, giving $k_{Fe^{+++}}/k_{O_2} = 0.004$, $k_{FeCl^{++}}/k_{O_2} = 0.23$ and $k_{FeCl_2^+}/k_{O_2} = 0.48$. (auth)

5241

RADIOSENSITIVE MOLECULAR WEIGHT OF TOBACCO MOSAIC VIRUS NUCLEIC ACID. William Ginoza and Amos Norman (Univ. of California, Los Angeles). Nature 179, 520-1(1957) March 9.

5242

RADIOCHEMICAL DEGRADATION OF DL-METHIONINE. Jaroslav Koloušek, Jindřich Liebster, and Arnošt Babický (Academy of Sciences, Prague). Nature 179, 521-3(1957) March 9.

5243

RADIOLYSIS OF TRI-N-BUTYL PHOSPHATE. T. F. Williams and R. W. Wilkinson (A.E.R.E., Harwell, Berks). Nature 179, 540(1957) March 9.

RADIATION EFFECTS

5244 AD-81585

Institute of Tech., Wright-Patterson AFB, Ohio.

THE CORROSIVENESS OF OIL DURING IRRADIATION (thesis). Carl E. Johnson, Jr. Mar. 15, 1955. 32p. (GNE-[55]-2).

Several corrosion-oxidation tests were performed at high temperature while air was bubbled through the lubricant. Metal samples were immersed in the oil for 72 hours. The corrosion was determined by the weight lost by each metal during the test. Some tests were performed after the oil had been irradiated, other tests were performed during irradiation, and still other tests involved no radiation at all. The samples which were irradiated received a dose of 4×10^7 roentgens in a Co^{60} source. The data obtained led to the conclusion that radicals produce little, if any, corrosion. The amount of corrosion caused by radicals was too small to be measured. (auth)

5245 CF-57-4-9

Oak Ridge National Lab., Tenn.

ACID FORMATION IN THE RADIOLYSIS OF PHOSPHORUS ESTERS. W. H. Baldwin. Apr. 3, 1957. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Samples of TBP were exposed to a Co^{60} source to determine what effect diluents, water, and oxygen have on the radiolytic decomposition of TBP and acid formation. (auth)

5246 HW-44092

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PLASTICS AND ELASTOMERS FOR USE IN RADIATION FIELDS. I. EFFECTS OF GAMMA IRRADIATION. Robert Harrington. Nov. 30, 1956. 41p. Contract W-31-109-Eng-52. $0.30(OTS).

The results obtained from exposing 48 plastics and elastomeric materials over a dose range of 3×10^6 r to 9×10^7 r are summarized. Spent reactor fuel elements were used as the source of γ radiation. Among the materials evaluated, a styrene-butadiene rubber (PR 408-70) appeared to be the least affected. Two acrylic materials (Acrylon BA-12 and EA-5) and two vinyl chloride materials (Vyflex L-10 White and Black) appeared almost equally as good as the styrene. Teflon was the poorest of the materials, being severely damaged at 3×10^6 r. Kel-F Elastomer and a butyl type (Hycar 2202) became soft and tacky, indicating their poor suitability for use in radiation fields. The acrylics, neoprenes, nitriles, and ethylenes appeared to be about equally damaged as classes, with some overlapping with respect to the individual materials within the classes. The silicone elastomers were generally damaged more severely, although the phenyl types were affected less. Although elongation is a sensitive property and provides a fairly good index of the degradation of the materials, a study of the effects on several properties is necessary to obtain the true condition of the materials. (auth)

5247

CHEMICAL EFFECTS OF IONIZING RADIATION ON PROTEINS. I. EFFECT OF γ-RADIATION ON THE AMINO ACID CONTENT OF INSULIN. Maurice P. Drake, J. Walter Giffee, Dorothy A. Johnson, and Virgil L. Koenig (QM Food and Container Inst. Armed Froces, Chicago). J. Am. Chem. Soc. 79, 1395-1401(1957) March 20.

This study was undertaken to determine the radiosensitivity of the constituent amino acids of a protein in order to provide information which might indicate the source of objectionable qualities of aroma and flavors that have been found to occur in the sterilization of food proteins by ionizing radiation. One per cent insulin in basic (pH 8.5) and in acidic (pH 3.0) solutions was subjected to 0, 10, 20 and 40 million r.e.p. γ-radiation doses. Cystine, tyrosine, phenylalanine, proline and histidine are demostrated to be very radio-sensitive. Leucine, valine, lysine and arginine are significantly destroyed at the high irradiation dose level. The nitrogen-terminal amino acids of insulin, glycine and phenylalanine, are shown to be deaminated. Cysteic acid is identified in the hydrolysates of the irradiated insulin. An

increase in molecular size of the irradiated insulin is reported. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

5248

AN INVESTIGATION OF THE SPECIES EXISTING IN NITRIC ACID SOLUTIONS CONTAINING CERIUM(III) AND CERIUM (IV). Bernard D. Blaustein and John W. Gryder (Johns Hopkins Univ., Baltimore, Md.). J. Am. Chem. Soc. 79, 540-7(1957) Feb. 5.

Extraction data and electromotive force measurements are interpreted as indicating the existence of $Ce^{4+}-Ce^{4+}$ and $Ce^{4+}-Ce^{3+}$ polymers in 5.5 f HNO_3 solutions. If the polymers are assumed to be dimers, the association constants for the reactions $2Ce^{4+} = (Ce^{4+})_2$, $Ce^{4+} + Ce^{3+} = Ce^{4+}Ce^{3+}$ in this medium are 17 ± 2 and 2.0 ± 0.7 at 30.0 ± 0.03° where total concentration of monomer and of dimer are used in the equilibrium expressions. Contradictory reports in the literature are reconciled by the existence of these dimeric species. The Ce^{4+} species extracted by ether is shown to contain no ionizable H_2. (auth)

5249

ION-EXCHANGE STUDY OF THIOCYANATE COMPLEXES OF THE ACTINIDES AND LANTHANIDES. J. P. Surls, Jr. and G. R. Choppin (Univ. of California, Berkeley). J. Inorg. and Nuclear Chem. 4, 62-73(1957) Feb.

The ion-exchange behavior of many tripositive actinides and lanthanides and yttrium from Dowex-1 anion-exchange resin with ammonium thiocyanate solutions has been studied. Lanthanides and yttrium elute sooner than actinides under all conditions studied. Neither lanthanides nor actinides showed a simple elution sequence of the members within the series. On elution from Dowex-50 with ammonium thiocyanate, the actinides eluted in the usual sequence of decreasing atomic number. The lanthanides studied also exhibited the usual elution sequence from Dowex-50; however, the actinides eluted sooner than the lanthanides of comparable ionic radius, indicating stronger complexing of actinides with thiocyanate. (auth)

Refer also to abstract 5208.

SEPARATION PROCEDURES

5250 AECU-3360(Pt. III)

Michigan. Univ., Ann Arbor.

RADIOCHEMICAL SEPARATIONS. III. SILVER. Duane N. Sunderman and W. Wayne Meinke. [1955?]. 19p. Contract [AT(11-1)-70]. $3.30(ph OTS); $2.40(mf OTS).

Chloride precipitation and electrodeposition, standard methods for the separation of radioactive Ag, have been evaluated and their efficiency of separation determined. Two new methods, precipitation with benzotriazole from ammoniacal versene solution and separation by isotopic exchange with a Ag halide surface, have also been studied. A comparison of the efficiency of separation from 13 typical radioactive tracers was made to facilitate the development of an optimum procedure to fit individual requirements for yield and decontamination. In the precipitation reactions, the solid retains a minimum of 0.5% to 2% of many contaminating elements. By comparison, both electrodeposition of Ag and its separation by isotopic exchange afford decontaminations by factors of 500 to 10^6 for these same elements. A sample procedure is given which illustrates the high decontaminations possible by a combination of these methods. (auth)

5251 AERE-C/M-147

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CONCENTRATION OF URANIUM BY MEANS OF THE ROTARY EXTRACTOR. R. Spence and R. J. W. Streeton. May 13, 1952. 3p.

5252 AERE-C/M-252

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CALCULATION OF THE PERCENTAGE REMOVAL OF A RADIOELEMENT IN A HIGH TEMPERATURE SEPARATION PROCESS WHEN THE ELEMENT IS FORMED AS A DAUGHTER FROM ANOTHER RADIOELEMENT. D. F. C. Morris and J. A. Birmingham. June 17, 1955. 6p.

In experimental investigations on different high-temperature separation processes, the efficiency of removal of radioelements has been determined by radiochemical activity analyses of the purified samples and of untreated standards. With this procedure, if the removal of a radioelement which is formed by the decay of another radioelement is being investigated, the apparant percentage removal will depend on the time between the separation process and analysis. The calculation for such cases of the percentage removal of the radioelement at the time of the separation process from analytical data obtained later is described and discussed. (auth)

5253 CF-51-9-177

[Oak Ridge National Lab., Tenn.]

DESIGN METHODS IN SOLVENT EXTRACTION. H. F. Johnson. Sept. 19, 1951. 31p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

Equations for evaluating capacity coefficients and heights of over-all transfer units for dilute and concentrated solvent extraction solutions have been developed. (auth)

5254 CF-57-3-43

Oak Ridge National Lab., Tenn.

VOLATILITY PILOT PLANT—DESIGN OF A NaF PACKED TOWER FOR REMOVING HF FROM FLUORINE. J. S. Watson. Mar. 7, 1957. 9p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

An adsorption column packed with ¼ in. NaF pellets was designed to reduce the HF content of the F_2 being used by the Volatility Pilot Plant from 5% to less than 0.01%. It will be a non-isothermal packed bed with the gas inlet heated to 100°C to avoid plugging and the exit cooled to 25°C for more complete HF removal. (auth)

5255 CRC-688

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont. and Canada. Dept. of National Health and Welfare, Ottawa.

RADIOCHEMICAL PROCEDURES FOR STRONTIUM AND YTTRIUM. Feb. 1957. Includes Paper: ION-EXCHANGE METHODS FOR THE QUANTITATIVE SEPARATION OF THE ALKALINE EARTHS AND THEIR APPLICATION TO THE DETERMINATION OF Sr^{90} IN MILK ASH. Gwen M. Milton and W. E. Grummitt. 37p.

A detailed ion exchange procedure is given for the determination of radiostrontium and Y^{90} in prepared samples, and a report covering the development of the cation method is included in an appendix. Two methods are described for the preparation of various organic materials for analyses. (auth)

5256 DOW-154

Dow Chemical Co. Western Div., Pittsburg, Calif.

PROGRESS REPORT [FOR] JANUARY–FEBRUARY 1957. Research Dept. R. H. Bailes. 20p. Contract AT-30-1-GEN-236. $3.30(ph OTS); $2.40(mf OTS).

The results of a continuation of a study of new methods for preparation of high-grade U products directly from solvent-extraction and ion-exchange process streams are reported. (For preceding period see DOW-152.) (auth)

5257 IGRL-T/CA-36

A METHOD OF PREVENTING EXPLOSIONS IN AIR-SEPARATION INSTALLATIONS. I. P. Ishkin and P. Z. Burbo. Translated by E. G. Peters from Kislorod 4, 26-34(1947). 13p.

A method for removal of acetylene from air to be liquefied is given. This method, involving adsorption on silica gel, should ensure explosion-free operation of O_2 and N_2 production plants. (T.R.H.)

5258 ISC-678

Ames Lab., Ames, Iowa.

EFFECT OF PHOSPHATE ROCK PARTICLE SIZE ON RECOVERY OF URANIUM FROM SUPERPHOSPHATE. William Wayne Davis and Morton Smutz. Dec. 1955. 31p. Contract W-7405-eng-82. $0.25(OTS).

The tremendous domestic reserves of phosphate rock together with the large annual production of normal superphosphate from phosphate rock have made the recovery of the small amounts of U (0.01 to 0.02%) in phosphate rock during the production of superphosphate an important problem. At current superphosphate production rates there exists a U potential of approximately 1000 tons per year. The purpose of this investigation was to make a quantitative study of the effect of phosphate rock particle size on the recovery of U during the production of normal superphosphate. Florida land pebble phosphate rock was used. The U content of this rock was 0.0184% U_3O_8. Phosphate rock particle sizes of 62, 77, and 92% through 200 mesh were studied. Both a 1.81 and a 2.50 acidulation ratio were studied at each particle size. Industrially, a 1.81 acidulation ratio is used for the production of normal superphosphate; a 2.50 acidulation ratio is used for phosphoric acid production. The acidulation of the phosphate rock to superphosphate and the extraction of the U into the solvent were accomplished simultaneously by adding the H_2SO_4 to a slurry of the rock and solvent. The solvent used was a 10 percent di-octyl pyrophosphoric acid solution in normal heptane. A solvent-to-rock ratio of 0.8 ml per gram was used throughout; 60% H_2SO_4 was also used throughout. The most favorable U recovery was 73%. When the 2.50 acidulation ratio was used an additional quantity of rock was added to the reaction products, after the solvent had been removed, to reach an over-all 1.81 acidulation ratio. Superphosphate was thus produced. This additional rock was not finely ground as it did not contact the solvent for uranium extraction. It was found that the U recovery obtained in a 30-min. reaction-extraction increased significantly with a decreasing particle size. The process based on an initial over-acidulation ratio (2.50) did not appear to have any advantage over the process based on the normal acidulation ratio (1.81). (auth)

5259 ISC-802

Ames Lab., Ames, Iowa.

SEPARATION OF NIOBIUM AND TANTALUM BY LIQUID EXTRACTION. Ernest L. Koerner, Jr., Morton Smutz, and H. A. Wilhelm. Dec. 1956. 68p. Contract W-7405-eng-82. $0.40(OTS).

A lab scale process was devised which produced several pounds of niobium oxide containing less than 700 ppm tantalum oxides and several pounds of tantalum oxide containing less than 100 ppm niobium oxides. The steps in the process are: digestion of ore or concentrate with HF, solvent extraction of Nb and Ta into methyl isobutyl ketone, solvent extraction separation of Nb and Ta, solvent extraction purification of Nb, and stripping and solvent regeneration. (T.R.H.)

5260 NAA-SR-1793

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

EQUILIBRIUM CONSIDERATIONS ON URANIUM DIOXIDE DROSSING OF IRRADIATED URANIUM. A. G. Buyers and E. W. Murbach. Mar. 1, 1957. 15p. Contract AT-11-1-GEN-8. $0.20(OTS).

Equilibrium constants and changes in standard free energies at 1473, 1548, and 1673°K have been calculated for skin and crucible-urania irradiated-molten-uranium contacting. Equilibria postulated included the formation of PuO_2, SrO, and Ce_2O_3 by the reduction of UO_2. Respective equilibrium constants were found to increase with temperature and vary from 1.3 to 3.2 for $\frac{1}{4}Pu \rightarrow \frac{1}{4}PuO_2$, 18.7 to 36.0 for $\frac{1}{2}Sr \rightarrow \frac{1}{2}SrO$, and 32.6 to 52.3 for $\frac{1}{3}Ce \rightarrow \frac{1}{6}Ce_2O_3$. Free energy changes were found to be more negative than those calculated from reported values. The plot of log Ke vs 1/T has indicated positive values for ΔH and ΔS, a situation which was not indicated by calculations for Ce and Sr. It was suggested that this anomaly might be explained by trapping of evaporated metal by the solid oxide layer and failure to attain thermodynamic equilibrium due to interfacial conditions. It is believed that the foregoing interpretation has disclosed a similarity between skin-oxide and crucible-oxide metal contacting, not revealed by the original evaluation of reported distribution data. (auth)

5261 NAA-SR-1855

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PRE QUARTERLY PROGRESS REPORT [FOR] OCTOBER–DECEMBER 1956. D. I. Sinizer, J. R. Foltz, K. L. Mattern, and E. E. Motta. Mar. 15, 1957. 55p. Contract AT-11-1-GEN-8. $0.40(OTS).

The designing and equipping of a Pyrometallurgical Reprocessing Experiment cold mockup is continuing. The mockup is to perform mechanical operations and provide for study of material transfer and handling of process metal simulating U fuel. (For preceding period see NAA-SR-1796.) (T.R.H.)

5262 ORNL-2245

Oak Ridge National Lab., Tenn.

PROCESS TEST SECTION PROGRESS REPORT FOR OCTOBER 1956. A. D. Ryon and K. O. Johnsson. Mar. 27, 1957. 18p. Contract W-7405-eng-26. $0.20(OTS).

The results are given of the second 100-cycle continuous run using secondary stripping on U leach liquor containing Mo. The present run used liquor containing 0.2 g/l Mo and secondary stripping with carbonate solution of the total organic flow. The run was entirely successful. (auth)

5263 RMO-2044

International Minerals and Chemical Corp., Chicago.

DIGESTION AND FILTRATION OF LEACHED ZONE IN PILOT PLANT. Gordon L. Dugger, J. B. Adams, and Roger Bart. Feb. 28, 1957. Decl. Oct. 27, 1955. 35p. Contract AT(49-1)-545. (IMCC-2215). $0.50(OTS).

5264 WAPD-PWR-CP-2126

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh].

REMOVAL OF CARRIER-FREE RADIOISOTOPES FROM PURE WATER BY MIXED-BED ION EXCHANGE COLUMNS; APPLICATION TO PWR WASTE DISPOSAL SYSTEM. W. T. Lindsay and C. S. Abrams. 35p. $6.30 (ph OTS); $3.00(mf OTS).

5265 WIN-65

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

LABORATORY INVESTIGATION OF RIVERTON STOCKPILE ORE. E. S. Porter and H. I. Viklund. Mar. 4, 1957. 23p. Contract AT(49-6)-924. $4.80(ph OTS); $2.70 (mf OTS).

On the basis of the results of the laboratory investigations, the Riverton stockpile ore is recommended for acid leaching followed by CCD washing and fixed bed ion exchange to recover the uranium. Proper control of the ferric iron concentration and the pH of the ion exchange feed should minimize phosphate interference. Two-stage countercurrent leaching would appear to have advantages over single stage leaching and is, therefore, recommended for future study. (auth)

5266 WIN-67

National Lead Co., Inc. Raw Materials Development Labs., Winchester, Mass.

ALKALINE LEACH—FILTRATION PILOT PLANT TESTING OF RIO de ORO DYSART SHAFT ORE. R. G. Beverly, W. A. Millsap, and Guy Winslow. Feb. 15, 1957. 57p. Contract AT(49-6)-924. $9.30(ph OTS); $3.60(mf OTS).

Test results show Rio de Oro Dysart Shaft ore to be amenable to either Pachuca or autoclave leaching in the Alkaline Leach-Filtration process. A grind of 1.2% plus 48 mesh and 52.8% minus 200 mesh was not too coarse for leaching or residue filtration. Generally, a grind of about minus 65 mesh is required on most ores to obtain optimum leaching. The ore fed to the process during the run averaged 0.238% U_3O_8. A leach residue of 0.007% U_3O_8 was obtained on this ore when leaching at 49% solids in an alkaline solution containing 35.4 g Na_2CO_3 and 15.3 g $NaHCO_3$ per liter for 50 hr in Pachuca tanks at a temperature of 180°F and atmospheric pressure with air added for oxidation. These leach conditions appeared to be ideal for optimum economic extraction in Pachucas. Lower extractions were obtained when leaching at about 57% solids and no significant advantage in leaching was realized when using 2 lb $KMnO_4$/ton in addition to aeration air for oxidation. A residue of 0.009% U_3O_8 was obtained in approximately 6 hr when the ore was subjected to an autoclave leach of 255°F and 70 psig pressure with air added for oxidation. Rio de Oro Dysart Shaft ore exhibited excellent filtration characteristics and no flocculant was necessary. Batch precipitation of the yellow cake from pregnant liquors obtained from both Pachuca and autoclave leaching was accomplished by heating the liquors to about 164°F and then adding NaOH to an average excess of 6.1 g/l. The final mill product averaged 77.70% U_3O_8. There was no significant difference in the quantity of impurities in the product produced by either leaching method. Over-all calculated U recovery based on accountable losses was 96.86%. Recovery based on yellow cake assays and weights was 97.12% resulting in an unaccountable gain of 0.26%. (auth)

5267

THE URANYL–AMMONIUM PHOSPHATE PROCESS FOR RECOVERY OF URANIUM FROM SLAG SCRAP. E. R. Johnson, E. O. Rutenkroger, A. B. Kreuzmann, and B. C. Doumas (National Lead Co. of Ohio, Cincinnati). Chem. Eng. Progr. 53, 56F-9F(1957) Feb.

The process developed involves the following steps: roasting and grinding of the scrap material, leaching the roasted and ground material with HCl to solubilize the U, precipitating the U from the filtered leach liquors as $UO_2NH_4PO_4$, and converting the $UO_2NH_4PO_4$ to $Na_2U_2O_7$ by slurring of the former with a NaOH solution. A detailed description of the process and equipment for plant-scale processing is presented. (W.L.H.)

5268

NEW PROCESSES PROMISE MORE ECONOMIC FISSION PRODUCT REMOVAL. S. Lawroski and W. A. Rodger (Argonne National Lab., Lemont, Ill.). Chem. Eng. Progr. 53, 70F-1F(1957) Feb.

The following separation processes for U from fission products are discussed; solvent extraction for natural U, volatility for natural U, volatility for enriched U–Zr fuel; and pyrometallurgical processing. (W.L.H.)

5269

DECONTAMINATION OF IRRADIATED URANIUM BY A FLUORIDE VOLATILITY PROCESS. William J. Mecham, Robert C. Liimatainen, Robert W. Kessie, and Waldemar B. Seefeldt (Argonne National Lab., Lemont, Ill.). Chem. Eng. Progr. 53, 72F-7F(1957) Feb.

A series of six pilot plant runs was made on 10-kg lots of U. The process steps, corrosion of equipment, process equipment, flowsheets and application of the process to enriched fuels are discussed in detail. (W.L.H.)

5270

PREPARATION OF POWER REACTOR FUELS FOR AQUEOUS PROCESSING. J. E. Savolainen and R. E. Blanco (Oak Ridge National Lab., Tenn.). Chem. Eng. Progr. 53, 78F-81F (1957) Feb.

New methods, Darex and Zircex Processes, for converting fuels fabricated of HNO_3-insoluble metals to HNO_3 solutions suitable for reprocessing by solvent extraction are discussed. (W.L.H.)

5271

ION EXCHANGE RECOVERS PLUTONIUM FROM IRRADIATED FUELS. A. M. Aikin (Atomic Energy of Canada Ltd., Chalk River, Ontario). Chem Eng. Progr. 53, 82F-5F (1957) Feb.

A pilot plant operation is presented for the separation of irradiated Pu from U by ion exchange. An advantage claimed for this process is that a small ion exchange unit can be put on a competitive basis with large solvent extraction units. (W.L.H.)

5272

ION EXCHANGE. Robert Kunin, Francis X. McGarvey, and Ann L. Farren (Rohm & Haas Co., Philadelphia). Ind. Eng. Chem. 49, 507-13(1957) March.

A literature review on ion exchange theory, applications, techniques, materials, and apparatus is presented. 274 references. (T.R.H.)

5273

LIQUID EXTRACTION. Robert E. Treybal (New York Univ., New York). Ind. Eng. Chem. 49, 514-25(1957) March.

A literature review is presented on the industrial aspects of liquid extraction. Analytical chemistry applications are excluded. 341 references. (T.R.H.)

5274

SOLVENT EXTRACTION STUDIES WITH POLONIUM. K. W. Bagnall and D. S. Robertson (U. K. Atomic Energy Authority, Harwell, Didcot, Berks.). J. Chem. Soc. 509-12 (1957) Feb.

The extraction of Po from HCl solution by dithizone may involve the complex $PoODz_2$, and the complex $PoCl_4 \cdot 2TBP$ may be formed in the extraction with TBP. The dependence of the partition coefficient on the acid concentration of the aqueous phase has been determined for both complex-forming agents. (auth)

5275

THE SEPARATION OF HYDROGEN AND DEUTERIUM BY THE REACTION OF IRON WITH STEAM. Hilton A. Smith

and John C. Posey (Univ. of Tennessee, Knoxville). J. Am. Chem. Soc. 79, 1310-13(1957) March 20.

The separation of H_2 and D_2 during the reaction of steam and Fe was measured over the range of 118 to 340°. Separation factors from 1.4 to 3.2 were observed. The data were found to be correlated by the equation $\log \alpha = 273.1/T - 0.2039$ where α is the isotope separation factor and T is the absolute temperature. Isotope separation factors obtained with Cd agreed within experimental error with those obtained witn Fe. The separation of H_2 and D_2 occurring during the reduction of magnetic iron oxide was measured and found to approach the equilibrium value. This is believed to have been caused by isotope exchange catalyzed by the freshly reduced Fe. (auth)

5276

A SELECTIVITY SCALE FOR SOME DIVALENT CATIONS ON DOWEX 50. O. D. Bonner and Linda Lou Smith (Univ. of South Carolina, Columbia). J. Phys. Chem. 61, 326-9 (1957) March.

Equilibrium studies involving Cu^{2+}, Zn^{2+}, Co^{2+}, Ni^{2+}, Mg^{2+}, Cd^{2+}, UO_2^{2+} and Pb^{2+} on Dowex 50 resins of approximately 4, 8 and 16% divinylbenzene content have been made at a constant ionic strength of approximately 0.1 M. These ions in addition to Ba^{2+}, Sr^{2+} and Ca^{2+} have been included in the same selectivity scale as the common univalent cations. Activity coefficient corrections have been made for the ions in the aqueous solution phase, and these corrections have been substantiated in some instances by the results of exchange reactions carried out at lower ionic strengths. It is observed that the order of decreasing activity coefficients for the nitrates of both the univalent and the divalent ions is the same as that of the selectivity scale. The characteristic maximum water uptake of the resin in these ionic forms is reported. (auth)

SORPTION PHENOMENA

5277 AERE-C/M-14

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SETTLING AND FILTERING PROPERTIES OF ALUMINIUM AND FERRIC HYDROXIDES, AND THEIR APPLICATION TO EFFULENT TREATMENT. R. Gaylor. Feb. 22, 1949. Decl. Nov. 21, 1956. 7p.

SPECTROSCOPY

5278

A PRELIMINARY SPECTROPHOTOMETRIC STUDY OF COMPLEX IONS IN FUSED SALTS. D. M. Gruen (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 4, 74-6(1957) Feb.

A spectrophotometric technique for the investigation of complex ions of transition metals in fused salts is presented. (W.L.H.)

TRACER APPLICATIONS

5279

ERRORS IN QUANTITATIVE TRACER STUDIES. EXAMPLES RESULTING FROM ISOTOPIC DILUTION AFTER SYNTHESIS. Gus. A. Ropp (Oak Ridge National Lab., Tenn.). J. Chem. Educ. 34, 60-3(1957) Feb.

TRANSURANIC ELEMENTS AND COMPOUNDS

5280 AERE-C/R-712

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SPECTROPHOTOMETRIC STUDIES OF PLUTONIUM IN NITRIC ACID SOLUTION. PART I. G. R. Hall, P. D. Herniman, and A. J. Walter. May 1, 1951. Decl. Dec. 12, 1956. 22p.

The preparation, stability, and absorption spectra of Pu^{3+}, Pu^{4+}, and Pu^{6+} in HNO_3 are given and discussed. (T.R.H.)

5281

THE EFFECT OF D_2O ON THE RATE OF THE REACTION BETWEEN OXYGEN AND Pu(III). F. B. Baker and T. W. Newton (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 61, 381-2(1957) March.

URANIUM AND URANIUM COMPOUNDS

5282 AERE-CE/R-1382

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PREPARATION AND PROPERTIES OF URANIUM, PLUTONIUM, THORIUM AND THE FISSION PRODUCT CHLORIDES. D. Bradley. 1954. Decl. Nov. 21, 1956. 46p.

5283 AERE-M/R-1235

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME OBSERVATIONS ON THE FORMATION OF URANIUM MONOXIDE. J. Williams and K. H. Westmacott. July 31, 1953. 29p.

5284 N-1722

[Chicago. Univ.] Metallurgical Lab.

THE PREPARATION OF UF_6 FROM UF_4 AND O_2. S[herman] Fried and N. R. Davidson. Nov. 14, 1944. Decl. May 15, 1956. 4p. (MUC-GTS-1118). $1.80(ph OTS); $1.80(mf OTS).

5285 N-2128

[Chicago. Univ. Metallurgical Lab.]

THE REACTION OF URANIUM COMPOUNDS WITH ALUMINUM CHLORIDE. Sherman Fried. Oct. 12, 1945. Decl. Mar. 6, 1957. 2p. (MUC-FWHZ-152). $1.80 (ph OTS); $1.80(mf OTS).

It was found that UF_4 reacts with $AlCl_3$ according to the following equation: $3UF_4 + 4AlCl_3 \rightarrow 3UCl_4 + 4AlF_3$. This reaction takes place from 250 to 500°C in a sealed tube. Thermodynamic calculations indicate that the heat of reaction is ~ -60 kcal when the heat of formation of UF_4 is taken as -446 kcal UCl_4 as -251 kcal, $AlCl_3$ as -167 kcal, and AlF_3 as -329 kcal. (W.L.H.)

5286 NYO-7544

Tufts Univ., Medford, Mass.

THE NON-STOICHIOMETRY OF URANIUM HYDRIDE. Period Covered: October 1, 1956 to February 13, 1957. George G. Libowitz. Feb. 25, 1957. 13p. Contract AT(30-1)-1355. $3.30(ph OTS); $2.40(mf OTS).

Equations were derived for the hydrogen pressure over non-stoichiometric metallic hydrides from statistical mechanical considerations. Two separate relations were obtained depending on whether lattice vacancies or interstitial atoms were taken to be the cause of hydrogen deficiency in hydrides. For the case of one-to-one binary hydrides, the two equations become identical. By comparing the pressure–temperature–composition data for U hydride with the derived equations, it was established that the non-stoichiometry of this compound was due to hydrogen vacancies in the lattice rather than interstitial U atoms. The energy necessary to form a hydrogen vacancy in U hydride was found to be 68.2 kcal/mole, while a value of 6.5 kcal/mole was determined for the interaction energy between vacancies. (auth)

5287

REACTOR GRADE URANIUM BY EXTRACTION OF SLURRIES. D. S. Arnold and B. G. Ryle (National Lead Co. of Ohio, Fernald). Chem. Eng. Progr. 53, 63F-4F(1957) Feb.

The application of TBP extraction of slurries to refining of U ores was investigated from the standpoint of the effects of various constituents on product purity, product recovery, and refinery operations. (W.L.H.)

5288

URANIUM RECOVERY FROM AQUEOUS WASTES. R. J. Clouse, J. Dykstra, and B. H. Thompson (Union Carbide Nuclear Co., Oak Ridge, Tenn.). Chem. Eng. Progr. 53, 65F-9F(1957) Feb.

The solutions collected from equipment cleaning at the Gaseous Diffusion Plant contain isotopically enriched U. The facility for recovering this U, processing it to the oxide, and fluorinating the oxide to UF_6 is discussed. (W.L.H.)

5289

A SYNTHETIC URANYL SILICATE HYDRATE. William L. Marshall and James S. Gill (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 79, 1300-1(1957) March 20.

A uranyl silicate hydrate was prepared by the reaction of an aqueous UO_2F_2 solution with silica at 300°. The chemical analysis of this yellow crystalline solid indicated the probable composition to be either $(UO_2)_2SiO_4 \cdot 3H_2O$ or $(UO_2)_3Si_2O_7 \cdot 3H_2O$. The compound is virtually insoluble in HCl, HNO_3 or H_2SO_4. It is thermally stable to approximately 400°. (auth)

5290

FIELD DETERMINATION OF URANIUM IN NATURAL WATERS. F. N. Ward and A. P. Marranzino. U. S. Geol. Survey Bull. 1036-J. 1057. 14p.

A simple and moderately accurate method for determining traces of uranium in natural waters has been devised to facilitate the development of hydrogeochemical prospecting techniques. The procedure eliminates the present practice of transporting bulky water samples from field to laboratory and the time-consuming evaporation of samples, preliminary to analysis. Under field conditions the uranium is separated from a water sample by means of a phosphate collector, and, after a paper-chromatographic separation, is determined by its reaction with ferrocyanide. The lower limit of the method is 2 ppb (parts per billion) and without modification it can be used to determine as high as 200 ppb of uranium in natural waters. Recoveries of 2, 5, and 10 micrograms of uranium added to 500 ml portions of a water sample are respectively 1, 5, and 7 micrograms. The analyses of 7 different binary mixtures prepared from natural water samples compare favorably with the values calculated from the mixture composition and the known uranium contents of the components. Five repeat determinations on a water sample containing 5 ppb agree within 1 ppb of the mean; similar determination on a sample containing 30 ppb agree within 4 ppb of the mean. Results by the proposed mehtod on samples containing from 2 to 30 ppb of uranium compare reasonably well with the fluorimetric results obtained by another laboratory of the United States Geological Survey. (auth)

WASTE DISPOSAL

5291 UK/C/4/113

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

DISPOSAL OF HIGHLY ACTIVE SOLUTIONS. 1. FISSION PRODUCT DISPOSAL IN GLASS. R. W. Durham and L. C. Watson. 2. WASTE DISPOSAL INTO THE GROUND. C. A. Mawson. [Paper Presented At] Fourth UK-Canada Technical Conference, October 17-19, 1955. 4p.

5292

VOLUME REDUCTION OF RADIOACTIVE WASTE BY CARRIER PRECIPITATION. R. E. Burns and M. J. Stedwell (Hanford Atomic Products Operation, Richland, Wash.). Chem. Eng. Progr. 53, 93F-5F(1957) Feb.

A new waste-scavenging process removes Cs^{137} and Sr^{90} on carrier precipitates, permitting the disposal of large volumes of wastes to ground. The demonstrated ability of metal ferrocyanides to remove Cs from aqueous wastes suggests their use in a Cs recovery process. (auth)

ENGINEERING

5293 AECU-3184

Michigan. Univ., Ann Arbor. Engineering Research Inst.

DESIGNS FOR POTATO IRRADIATION FACILITIES. L. E. Brownell, J. V. Nehemias, and J. J. Bulmer. Nov. 1954. 40p. Contract AT(11-1)-162. (ERI-1943-7-23-P). $0.30(OTS).

Designs are presented for potato irradiation facilities. The three gamma sources considered include refined Cs^{137}, concentrated anhydrous mixed fission products, and cooling reactor fuel elements. Design features are described and illustrated for facilities using each source, and cost data are included. (C.H.)

5294 CF-57-3-44

Oak Ridge National Lab., Tenn.

SEMIPERMANENT FREEZE PLUG TESTS FOR HRT-CP. R. H. Winget. Mar. 11, 1957. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Five uninsulated semipermanent freeze coils, series connected, can be frozen when submerged in 70°F water with a Freon-11 flow rate of 1.85 gpm at an inlet temperature of −40°F. The refrigeration unit of the HRT-CP is capable of delivering >3 gpm to a similar semipermanent freeze coil system located in Cell C. Therefore the number of F-11 risers required in Cell C of the HRT-CP can be minimized by series connecting this many semipermanent freeze coils where required. (auth)

5295 HW-40322

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PUREX PLANT SMALL PULSE GENERATOR OPERATION. P. B. McCarthy. Dec. 7, 1955. 9p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The leakage rate past the piston of a small Purex pulse generator is not affected significantly by pulse frequency. With the piston weep hole plugged, about 0.05 gal./min. leaks by the piston. With a $^3/_{64}$-in.-diameter weep hole, the leakage rate does not exceed 0.20 and 0.22 gal./min. for organic (30 vol. % TBP in hydrocarbon diluent) and water, respectively. Not more than one standard cfm of air is required to maintain a static balance (no liquid leakage past the piston) between the pulse leg and the pulse column. All air in the pulse leg is vented to the column in less than 3 min. (auth)

5296 AEC-tr-2850

STATIC CALCULATION OF BOILER BOTTOMS. (Statische Berechuung von Kesselboden.) Maria Esslinger. Published by Julius Springer (Berlin, 1952). p.39-100. 65p.

The first part of this paper (p.1-39), is identified as AEC-tr-2676.

Differential equations are developed for evaluating stress-

es and strains in cylindrical shell boilers. Boilers having riveted and welded seams and concave and convex ends are considered. (D.E.B.)

HEAT TRANSFER AND FLUID FLOW

5297 HW-47892
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
HEAT TRANSFER "BEYOND BURNOUT" FOR FORCED CONVECTION BULK BOILING. L. H. McEwen, J. M. Batch, D. J. Foley, and M. R. Kreiter. Jan. 21, 1957. Decl. Jan. 29, 1957. 20p. Contract [W-31-109-eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The results of experiments with forced circulation annular flow heat transfer to boiling water at 1500 psia pressure in a horizontal electrically heated test assembly are presented. The experiments comprised measurements of heater rod surface temperatures near and in the region of transition between nucleate and film boiling at heat fluxes of from 100,000 to 396,000 Btu/hr sq ft and with steam qualities up to 56% by weight. Apparent phase stratification led to heater rod temperatures which produced a smooth transition from the nucleate to the film boiling portions of the boiling curve. (auth)

5298 NP-6233
Mine Safety Appliances Co., Callery, Penna.
INDUSTRIAL SURVEY ON ORGANIC HEAT TRANSFER MEDIA, EQUIPMENT AND OPERATING EXPERIENCE. Technical Report No. 56. K. R. Barker, J. W. Mausteller, and C. J. Gleaser. Feb. 28, 1957. 45p. Contract NObs-65426.

A questionnaire was sent to 118 companies using organic heat transfer media to obtain data on operating conditions and equipment. Returns were received on 40 units and have been correlated to give a representative cross section of successful industrial practices. Leakage problems have been slight. Fire hazard is low. No special health problems have developed in the use of organic media. Standard equipment of many types is giving satisfactory service. Detailed comments which were added to the questionnaire proved of great interest, and are included. (auth)

5299 WAPD-A1W(IM)-3
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
INVESTIGATION OF BURNOUT HEAT FLUX IN RECTANGULAR CHANNELS AT 2000 PSIA. H. S. Jacket, J. D. Roarty, and J. E. Zerbe. [Dec. 5, 1955]. 52p. Contracts [AT-11-1-GEN-14 and NObs-56404]. $0.35 (OTS).

Burnout heat flux data under conditions of zero exit quality and bulk boiling at the exit of electrically heated test specimens were obtained in the Bettis Burnout Loop. Specimens were long, narrow channels with various slot thicknesses, surfaces, materials and length-to-diameter ratios. Tests were run at 2000 psia and mass velocities from about 0.2×10^6 to 4×10^6 lbs/hr-ft^2. The effect of inclining the channel at 45° was also investigated. The zero exit quality and bulk boiling results are in reasonable agreement with data previously obtained for round tubes. A design equation is suggested which yields a conservative estimate of the burnout heat flux in the low subcooling and quality regions for the range of variables investigated. A description of the Bettis Burnout Loop and method of operation are presented. (auth)

5300
HEAT TRANSFER. E. R. G. Eckert, James P. Hartnett, T. F. Irvine, Jr., and P. J. Schneider (Univ. of Minnesota, Minneapolis). Ind. Eng. Chem. 49, 565-76(1957) March.

A literature review is presented on heat transfer. The material is divided into sections on: Heat Conduction; Channel Flow; Boundary Layer Flow; Flow with Separated Regions; Transfer Mechanism; Natural Convection; Free and Forced Convection from Rotating Surfaces; Transpiration and Mass Transfer Cooling; Change of Phase; Radiation; Heat Transfer Applications (measurement techniques; heat exchangers, nuclear reactors, aeronautics, thermal stress and shock). 219 references. (T.R.H.)

5301
FINNED TUBE. ITS PLACE IN NUCLEAR ENGINEERING. Nuclear Eng. 2, 115-16(1957) March.

MATERIALS TESTING

5302 WADC-TR-56-663
Quantum Inc., Cheshire, Conn.
FUNDAMENTAL STUDIES ON THE ADHESION OF ORGANIC MATERIALS TO METAL SUBSTRATES. R. L. Patrick and W. A. Vaughan. Dec. 1956. 86p. Project Title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task Title: RESEARCH IN PHYSICAL PROPERTIES OF FILMS AND SURFACES. Contract AF33(616)-2465. (AD-118054).

The controlling factors which influence the bonding of adhesives and protective coatings to metal surfaces were investigated. Model systems were prepared in order to examine the phenomenon of adhesion. Single interface models were prepared by depositing monolayers on suitable metal substrates. Weight is added as bulk polymer and is polymerized directly onto the monolayer forming C-C bonds. The samples are ruptured in a modified ultracentrifuge and rupture-stress values are obtained. The results approximate pure tension values. By proper selection of substrates, it is possible to examine the monolayer prior to rupture testing. An ellipsometer is utilized for this procedure. Following rupture testing, the monolayer is again examined to determine whether or not the monolayer in the interface is removed from the metal substrate. In no case has the monolayer been removed. Values from 0.1 to several times the original monolayer thickness have been observed. (auth)

5303 WAPD-CTA(EDX)-275
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
RESULTS OF FRICTION AND WEAR INVESTIGATION FOR 200°F TO 500°F WATER APPLICATION. Interim Report to May 1, 1956. N. B. Dewees, B. Levy, I. A. Marsh, and D. E. White. June 1, 1956. 27p. Contract NObs-67500.

PUMPS

5304 AEC-Tr-2864
HIGH PRESSURE PUMPS AND MACHINES. C. H. Futterer. Translated by R. C. Murray from Chem. Ing. Tech. 28, 337-42(1956). 8p.

A description is given of present day high-pressure compressors for gases, gas circulating pumps to operate at high pressure, high-pressure machines for pressurizing liquids, expansion machines, and coal slurry hydraulic delivery presses. (auth)

5305
ELECTROMAGNETIC PUMPS FOR LIQUID METALS. D. A. Watt (Atomic Energy Research Establishment, Harwell, Berks). Engr. 181, No. 4703, 264-8(1956) April.

The elementary considerations affecting the design and application of compensated d-c and travelling field a-c

pumps for liquid metals are given. A brief survey of electromagnetic pumping equipment developed by U. K. A. E. A. is included. (T.R.H.)

MINERALOGY, METALLURGY, AND CERAMICS

5306 RMO-3000
Grand Junction Operations Office, AEC
A METHOD FOR PRESENTATION OF COST ESTIMATES AND PROCESS ECONOMICS AS RECOMMENDED BY THE ATOMIC ENERGY COMMISSION. John Klemenic. July 26, 1956. 25p.

CERAMICS AND REFRACTORIES

5307 WADC-TR-56-85
National Bureau of Standards, Washington, D. C.
EFFECT OF CERAMIC COATINGS ON THE CREEP RATE OF METALLIC SINGLE CRYSTAL AND POLYCRYSTALLINE SPECIMENS. [Summary Report For] June 15, 1952 through September 30, 1955. J. R. Cuthill and W. N. Harrison. Apr. 1956. 52p. Project 7350. Contract AF33(616)-52-19. (AD-104315).

The NBS No. N-143 ceramic coating was found to improve very significantly the creep characteristics of 80Ni–20Cr alloys at 1975°F, and to almost completely inhibit the formation of voids, which occurred in uncoated specimens of these alloys. The N-143 ceramic coating is a barium-silicate coating containing cerium oxide to impart increased refractoriness. At 1800 and 1900°F the coating imparted little or no improvement to the creep behavior of these alloys at normal strain rates. A detrimental effect was observed at very high-strain rates. The diffusion rate at 1400°F of H through high-purity Ni coated with NBS No. A-418 ceramic coating was found to be less than 5% of the diffusion rate through the uncoated Ni, although the ceramic coating applied to the Ni was only about $\frac{1}{40}$ as thick as the Ni specimen. However, in tests made at 1400°F and 3650 psi, there was no significant difference between the creep behavior in H of uncoated high-purity Ni and high-purity Ni which has been coated with NBS A-418 ceramic coating. The creep rate at 1500°F and 1000 psi of $\frac{1}{4}$-in. diameter single crystal specimens of high-purity Ni was found to be unaffected by a change in atmosphere from reducing to oxidizing. The presence of grain boundaries and C were found to be necessary for the creep rate to be affected by a change in atmosphere from H to air, but even then the observed effect was small. (auth)

CORROSION

5308 ALI-C-59291
Little (Arthur D.) Inc., Cambridge, Mass.
CORROSION-INHIBITING MATERIALS AND METHODS FOR MAGNESIUM ALLOYS. Final Report [for] September 2, 1954 to March 2, 1955. Apr. 22, 1955. 31p. Contract NOas-55-173-c. (AD-99227).

Development of materials and methods for their application to inhibit the corrosion of Mg, both alone, when coupled with Al or steel, and when the protective coating material is scratched to the bare metal is reported. Methods were devised for the synthesis of several new classes of compounds, the members of which might be useful as corrosion inhibitors. These include esters of vanadic, tungstic, and chromic acids, an amine molybdate, and an amine tungstate. The corrosion-inhibiting properties of several new compounds prepared by these new methods had not been explored until this time. A rapid method of evaluating the resultant compounds was devised. This method is based on determining the nonaqueous corrosion potential of Mg in the presence of these compounds. Based on the results of two test runs, in which good correlation was obtained with salt-spray evaluations of equivalent protective coatings, the method shows promise of being a useful, rapid screening tool. (auth)

5309 BMI-1160
Battelle Memorial Inst., Columbus, Ohio.
CORROSION STUDIES IN ORGANIC HEAT-EXCHANGE MEDIA. Walter K. Boyd, G. Lee Ericson, Oliver M. Stewart, Paul D. Miller, and Robert S. Peoples. Jan. 28, 1957. 43p. Contract Nos. NObs-65057.

The corrosion behavior of Zr base materials, Hf, high-strength Al alloys, and Type 304 stainless steels was studied. Such studies were conducted in isopropyl biphenyl and in biphenyl, with and without additions of water and H, over the temperature range 600 to 800°F. The materials were evaluated on the basis of weight gain, changes in bend ductility, and metallographic examination of the samples after exposure to the selected test conditions. Two types of attack were found: oxidation from water in the organic fluids, and hydriding from H which was added or was generated by decomposition of the organic material. Corrosion or the formation of an oxide film on the structural materials was found to be a function of the water content of the organic compound. Unalloyed crystal-bar Zr, Zircaloy 2, and Zircaloy 3A were quite resistant to biphenyl at 800°F and to isopropyl biphenyl at 700°F when the water content of the organics did not exceed 200 ppm. On the other hand these materials were severely attacked at 800°F by biphenyl containing 400 ppm water. At 700°F in isopropyl biphenyl containing 3400 ppm water, all the Zr-base materials with the exception of Zircaloy 2 exhibited heavy coatings of corrosion product and high weight gains. Type 304 stainless steel and Hf had excellent corrosion resistance under all test conditions at 600, 700, and 800°F, while the Al alloys showed moderate attack at 700°F in isopropyl biphenyl containing 3400 ppm water. The major limiting factor in the use of Zr-base materials in the organics is H embrittlement. At temperatures of 700°F and above, additions of H result in severe embrittlement of the Zr-base materials. Embrittlement of the Al alloys and Type 304 stainless steel was not observed in any of the tests. Pretreatments of Zr-base materials consisting of an 18 hr exposure in 750°F steam or anodizing in 70% HNO_3 were effective in reducing H absorption. However, these treatments did not prevent embrittlement after extended exposure periods. (auth)

5310 NP-6231
Mine Safety Appliances Co., Callery, Penna.
HIGH VELOCITY CORROSION STUDY IN ORGANIC MEDIA. Technical Report No. 54. K. R. Barker and J. W. Mausteller. Feb. 27, 1957. 31p. Contract NObs-65426.

Corrosion tests in organic coolants were conducted in a pumped corrosion test loop designed for test exposure at four velocities, 0, 4, 9, and 27 ft/sec. Two 30-day runs were completed using biphenyl coolant at a temperature of 800 F and surge tank pressure of 300 psig. Samples of Zr–7 wt. % U, Zircaloy 2, Zircaloy 3, Hf, Type 304 stainless steel, two Alcoa Al alloys and carbon steel were placed in the several velocity sections of the loop. Zirconium, Zr alloys, and Hf were severely hydrided but the

steels and Al alloys were relatively unaffected. The effect of velocity was apparent only in the Zr and Zr alloy results. Performance of the various components is discussed. (auth)

5311 NRL-Memo-581
Naval Research Lab., Washington, D. C.
EVALUATION OF CROLOY STEEL FOR SODIUM USE. B. F. Brown. Mar. 23, 1956. 14p. Project No. NS 200-021.

The resistance of Croloy 2¼ to corrosion by Na was studied in thermal convection harps. The results of these tests indicate that there is no mass transfer of Croloy 2¼ at 500°C (923°F) maximum temperature with a delta T of 175°C (315°F), no decarburization of Croloy 2¼, no carburization of Type 347 stainless steel in the presence of Croloy, and no detectable difference in effect of O concentration in Na at 0.003 wt. % and 0.014 wt. %. (auth)

5312 RCTC/P-33
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
PRELIMINARY WORK ON CORROSION IN CAUSTIC SODA. J. N. Gregory and P. F. Wace. Nov. 18, 1954. Decl. Dec. 6, 1956. 12p.

High-temperature corrosion tests in NaOH were performed on Ni, Fe, Al, Al–Si system, Ag, and Ni alloys. Good corrosion resistances of Ni and Ag were confirmed. (W.L.H.)

5313
THE ATTACK OF UNSTRESSED METALS BY LIQUID MERCURY. J. F. Strachan and N. L. Harris (General Electric Co., Ltd., Wembley, Eng.). J. Inst. Metals 85, 17-24. 1956-57.

The saturated solubilities and weight losses at room temperature of most of the metallic elements in static liquid Hg have been determined, usually to 0.001%, by chemical analysis of the solutions and by weighing the specimens. The solubilities show a periodic relationship with the atomic number, and there are indications that this can be related to the inner electronic shell structure. In general, the solubilities of the B sub-group elements exceed those of the true metals, while of this latter group the transition metals show the lowest values. When attack occurs, it involves wetting, surface amalgamation, solution, and occasionally combination and intergranular penetration. The effect of oxide films has been investigated. The tests were conducted as far as possible in the absence of air, since oxidation brought some metals out of solution in Hg, leading to ambiguities. Exposure to air can result, for example, in a form of mass transfer. No significant changes take place in the mechanical properties of Fe, Mo, some steels, and Ni alloys after 2000 hr. in Hg at 500°C. Nickel suffers a decrease in maximum, stress, yield stress, and elongation of about 50%. Severe cavitation erosion of metals and alloys, normally resistant to Hg, occurs at room temperature on the application of 30 kc./s. ultrasonic vibrations. (auth)

5314
THE SOLUBILITY OF SODIUM HYDRIDE IN SODIUM. D. D. Williams, J. A. Grand, and R. R. Miller (Naval Research Lab., Washington). J. Phys. Chem. 61, 379-81(1957) March.

GEOLOGY AND MINERALOGY

5315 RME-3118
Bureau of Mines and Geological Survey.
MONAZITE PLACERS ON RABON CREEK, LAURENS COUNTY, AND BIG GENEROSTEE CREEK, ANDERSON COUNTY, SOUTH CAROLINA. Leland A. Hansen and Dabney W. Caldwell. Feb. 1955. 25p.

Correlation of tenor in monazite and lithology of sediments among the drill sites on Rabon and Generostee Creeks is difficult. Differences in tenor in monazite and black sand in the alluvium at each drill site are attributed to changes in lithology of the alluvium and to variations in amount of monazite in the source rocks. A total of 19 holes was drilled on Rabon Creek and 12 on Big Generostee Creek for an average minable depth of approximately 16 ft. Analytical results show that both areas have low tenors of monazite and heavy minerals. Big Generostee Creek is virtually blocked in several places by rock outcrops, but otherwise both areas are large and physically attractive for placer mining. North Rabon and South Rabon Creeks have about 52 million yd^3 of minable alluvium. This alluvium contains approximately 5.5 lb of black sand per yd^3, of which about 0.42 lb. is monazite. Big Generostee Creek has about 43 million yd^3 of minable alluvium containing approximately 12 lb of black sand with about 0.44 lb. of monazite per yd^3. In round numbers the total monazite reserves on Rabon Creek are 11,000 tons, and on Big Generostee Creek 9,500 tons. (auth)

5316 RME-3128
Bureau of Mines.
DEADWOOD CONGLOMERATE MONAZITE DEPOSIT BALD MOUNTAIN AREA, SHERIDAN AND BIG HORN COUNTIES, WYOMING. A. A. McKinney and H. W. Horst. Mar. 1953. 39p. $0.30(OTS).

Ninety-two holes, averaging 22 ft and totaling 2,020 ft, were drilled with a rotary drill, and a total of 427 samples, weighing approximately 27 tons, was recovered. The samples were concentrated and analyzed. During the exploration of the Deadwood Conglomerate in the Bald Mountain Area, it was learned that all of that formation contained some monazite, the amount usually of little significance. The conglomerates explored by drilling were those which appeared on the surface or were discovered a short distance below the surface. More than likely many times this quantity of similar deposits have not yet been exposed by erosion. Tonnages of those beds could exceed that which was explored. The most significant fact developed during this exploration was the finding of a high-grade monazite stratum within the area explored. (auth)

5317 RME-3137(Pt. II)
Minnesota. Univ., Minneapolis.
ANNUAL REPORT FOR APRIL 1, 1955 TO MARCH 31, 1956. PART II. John W. Gruner, Deane K. Smith, Jr., and James A. Knox. Apr. 1, 1956. 25p. Contract AT (30-1)-610. $0.25(OTS).

Mineral determinations in U deposits and prospects in Wyo., northwestern Colo. and western S. Dak. and N. Dak. are tabulated, and a brief report on the crystal structure of uranophane is presented. (J.E.D.)

5318
DETERMINATION OF THE ABSOLUTE AGE OF THE PITCHBLENDES FROM KALONGWE AND LUISHYA (KATANGA–BELGIAN CONGO). D. Ledent. Bull. soc. belge geol. paleontol. et d'hydrol. 65, 230-3(1956). (In French)

5319
DETERMINATION OF THE AGE OF YTTROCRASITE OF MITAWBA (KATANGA) BY THE LEAD METHOD. I. CHEMICAL MEASUREMENTS. D. Ledent, E. Picciotto, and G. Poulaert (Univ. Libre de Bruxelles). Bull. soc. belge. geol. paleontol. et d'hydrol. 65, 233-50(1956). (In French)

5320
MEASUREMENT OF THE AGE OF YTTROCRASITE OF MITAWBA (KATANGA) BY THE LEAD METHOD. II. ISOTOPIC MEASUREMENTS. P. Eberhardt, J. Geiss, H. R. von Gunten, F. G. Houtermans, and P. Signer. Bull. soc. belge geol. paleontol. et d'hydrol. 65, 251-6(1956). (In French)

5321

MINERALS OF URANIUM. V. E. Gerasimovsky. Soviet J. Atomic Energy 4, 573-85(1956).

Knowledge about the minerals of uranium is summarized and the conditions of their formation are considered. A table of the physical properties of the most widely distributed minerals of uranium is included. (auth)

5322

RECONNAISSANCE STUDY OFU RANIUM DEPOSITS IN THE RED DESERT SWEETWATER COUNTY, WYOMING. Donald G. Wyant, William N. Sharp, and Douglas M. Sheridan. U. S. Geol. Survey Bull. 1030-I. 1956. 75p. and 8 illus.

The largest known deposit of schroeckingerite, a secondary uranium mineral, and uraniferous lignite occur in part of the Red Desert, north of Wamsutter, in northeastern Sweetwater County, Wyoming. Schroeckingerite was discovered on Lost Creek, 38 miles north of Wamsutter in 1936, and lignite between Lost Creek and Wamsutter was found to be uraniferous in 1945. It may be possible to produce uranium from the schroeckingerite deposit economically, but the outlook for commercial exploitation of the uraniferous lignite is at present uncertain. Three main uraniferous lignite beds, each about 10 feet thick and separated by 45 to 80 feet of sandstone and claystone, crop out in the southern part of the Red Desert. A fourth bed, postulated from drill cuttings, probably underlies the three main beds. Unweathered lignite is glossy black, and thin bedded. The uranium content of the lignite beds ranges from 0.002 to 0.007%. The average ash content of the lignite is about 38% and the ash contains from 0.004 to 0.022% U. The U in all lignite outcrops is not in radioactive equilibrium, probably because some of the uranium originally present has been leached from the outcrop. The time and mode of introduction of U in the lignite, as well as the source of U, remain problems. Data gathered during this investigation suggest that U was present in the decaying vegetal matter before it was coalified. More recent studies, in other areas, suggest that U in coal may be epigenetic. The Lost Creek schroeckingerite deposit is within the Cyclone Rim fault zone north of the outcrops of uraniferous lignite. A bed of such lignite, however, probably underlies the deposit at a depth of a few hundred feet. Within the fault zone, the beds strike northwestward and dip about 20° NE. Schroeckingerite is a water-soluble, fluorescent, bright yellow-green U salt. Minerals, other than detrital quartz and feldspar, that are commonly associated with schroeckingerite are clay, gypsum, aragonite, opal, and efflorescent white salts. Schroeckingerite characteristically occurs in the Lost Creek deposit as round pelletal aggregates, as disseminated flakes, or as thin layers. The layers commonly coat the ground surface and the flakes are commonly in beds of sandstone. The pellets, concentrations of which constitute ore bodies, are distributed irregularly but appear to be localized most abundantly in five principal beds of finer-grained rocks, shale, claystone, or siltstone (of Eocene age); these beds are separated by as much as 100 feet of virtually nonuraniferous sandstone and arkose. Ore bodies are about 1 foot thick and extend as much as 35 feet down the dip of the beds and a maximum of more than 300 feet along the strike. The U content ranges from 0.013 to 0.28%. Schroeckingerite crystallizes near the surface from ascending alkaline ground water, preferentially in moist claystone, shale, or in siltstone beds; the process differs genetically from deposition of caliche only in the quasi-stratigraphic control. The source of the uranium is not certain. It is possible that U, transported by ascending ground water circulating within the Cyclone Rim fault zone, and derived from uraniferous lignite, may have been deposited above the low water table prevailing at times in the Pleistocene epoch; later the rise of the water table may have caused the U mineral to be dissolved, transported, and recrystallized as schroeckingerite. Schroeckingerite may now be forming from migrating ground water at about the same rate that it is being dissolved and removed by surface water. Further geologic and exploratory work on the uranium deposit in the Red Desert will be done. (auth)

5323

PHOTOGEOLOGIC MAP OF THE NAVAJO MOUNTAIN–10 QUADRANGLE, SAN JUAN COUNTY, UTAH, MAP I-233. R. J. Hackman. Washington, U. S. Geological Survey. 1957. Price $0.50.

5324

PHOTOGEOLOGIC MAP OF THE NAVAJO MOUNTAIN–14 QUADRANGLE, SAN JUAN COUNTY, UTAH, AND COCONINO COUNTY, ARIZONA, MAP I-238. R. J. Hackman. Washington, U. S. Geological Survey. 1957. Price $0.50.

METALS AND METALLURGY

5325 AD-50244

Western Gear Works, Lynwood, Calif.

DEVELOPMENT OF TITANIUM AND TITANIUM ALLOY GEARS FOR AIRCRAFT AND GUIDED MISSILE COMPONENTS. Phase II Report. E. T. Bergquist, J. K. Morris, S. W. Pohl, and J. R. Young. Nov. 1954. 150p. Contract AF33(600)-24134.

5326 AD-78107

Allegheny Ludlum Steel Corp. [Research Dept., Watervliet, N. Y.].

INVESTIGATION OF FORGED COBALT BASE ALLOYS FOR HIGH TEMPERATURE APPLICATIONS. Progress Report No. 1 [for] February 1, 1955 to August 31, 1955. R. R. MacFarlane, E. E. Reynolds, and W. W. Dyrkacz. Aug. 31, 1955. 14p. Contract AF33(616)-2882.

Improvement in rupture strength and oxidation of a wrought Co-base alloy by the addition of Al, B, and Ti is the main object in this investigation. Al appears to have benefitted oxidation resistance at 1700 and 2000°F while impairing the rupture strength at 1600 and 1700°F. Air melted heats containing Ti additions above 1.0 and 0.2% B additions were not forgeable. (auth)

5327 AD-83186

Battelle Memorial Inst., Columbus, Ohio.

CAUSES OF CRACKING IN HIGH-STRENGTH WELD METALS. Progress Report [for] June 15 to September 15, 1955. A. L. Lowe, Jr., and R. P. Sopher. Sept. 15, 1955. 26p. Contract AF33(616)-2734.

A study made to determine the effect of a change in strain rate on the properties of experimental steel at 1000 and 2000°F showed that a change in strain rate from about 100 in./in. min to 700 in./in./min had little effect on the strength and ductility properties of the test specimens. Differences in strength values for a high-P steel below 1000°F were attributed to microcracks. No microcracks were found when the test specimens were permitted to contract freely during the first stages of cooling. Tests on 2 special heats of steel with low and high N indicated that the normal N content for this grade of steel has little influence on high-temperature ductility or weld-metal cracking. Results of hot-tension and weld-cracking tests showed that rare-earth additions increased high-temperature ductility and reduced weld-metal cracking. An experimental high-Si heat was tested over the temperature range from 2600 to 500°F. The ductility was good at high temperatures and suggests that the cracking resistance is also good. At elevated temperatures, the strength was similar to that of other steels. Between 700 and 500°F,

the strength was higher than that of other steels. (See also WADC-TR-52-322 Pt.4.) (auth)

5328 AERE-Lib/Trans-673
X-RAY INVESTIGATION OF THE DEFORMATION AND BOND STRENGTH IN THE CRYSTAL LATTICE OF METALS AND ALLOYS. G. V. Kurdyumov, V. A. Il'ina, V. K. Kritzkaya, and L. I. Lysak. Translated by J. Adam from Izvest. Akad. Nauk S.S.S.R. 17, 297-312(1953). 17p.

Measurements of x-ray diffraction line widths and intensities yield fundamental data related to the fine structure of metals and alloys. These are: sizes of coherent scattering domains for x rays, magnitude of elastic deformation in crystallites, amplitudes of atomic thermal vibrations and static disordered displacements of atoms in the lattice. Based on these methods are studies of phenomena of hardening and softening of metals and alloys. (auth)

5329 AERE-N/M-61
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DRYING OF POWDERS FOR NEUTRON TRANSMISSION MEASUREMENTS—I. R. T. Jackson and P. A. Engelstaff. Sept. 23, 1953. Decl. Nov. 22, 1956. 10p.

The water content of several powders is determined by neutron transmission measurements. It is found that metallic powders can be dryed fairly easily, but that the drying of oxides is more difficult possibly due to the formation of hydroxides. (auth)

5330 AGC-AE-35
Aerojet General Corp., Azusa, Calif.
THE REACTION OF MOLTEN METAL WITH WATER. Monthly Progress Report [for] February 1 through February 28, 1957. Mar. 29, 1957. 6p. Contract AT(04-3)-44. (AGC-L2914-24). $1.80(ph OTS); $1.80(mf OTS).

Six explosion dynamometer tests were performed on molten Zr using 10 and 20g samples. The study of burning rates of Mg ribbon under 1 cm/sec O_2 flow at one atmosphere pressure continued. (For preceding period see AGC-AE-34). (W.L.H.)

5331 BM-B-561
Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.
ZIRCONIUM: ITS PRODUCTION AND PROPERTIES. Stephen M. Shelton. Jan. 1955. 188p.

5332 CF-57-2-112
Oak Ridge National Lab., Tenn.
INERT ATMOSPHERES IN NON-VACUUM CHAMBERS FOR WELDING APPLICATIONS. W. J. Leonard. Feb. 6, 1957. 15p. Contract [W-7405-Eng-26]. $3.30(ph OTS); $2.40(mf OTS).

In the HRP welding program, a major part of the welding and fabrication, and some of the testing, is performed using an inert atmosphere. A general discussion is presented of the methods used, description of equipment, processes, quality of atmospheres, purity requirements, and kinetics of metal–gas reactions. (W.L.H.)

5333 IGR-R/C-190
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
THE NIOBIUM–HYDROGEN SYSTEM. D. R. Knowles. Mar. 1957. 32p.

The Nb–H_2 system has been discussed and compared with the Ta–H_2 and Pa–H_2 systems. It has been shown that all three systems are similar, consisting of two solid solutions separated by an interval of immiscibility. It has been confirmed that the distended solid solution is distorted, and that the true unit cell is probably face centered orthorhombic. It has also been shown that the cell size of the distended solid solution increases with H_2 content. (auth)

5334 ISC-700
Ames Lab., Ames, Iowa.
THE STRESS-STRAIN CHARACTERISTICS OF URANIUM. David A. McCutchan and Glenn Murphy. Dec. 1955. 41p. Contract W-7405-eng-82. $0.30(OTS).

The results of reversed loading and repeated tensile loading tests on rolled α uranium at room temperature are reported. Constant strain rates employed ranged from 0.0003 to 0.0060 in./in./min. The results and conclusions drawn are discussed. (T.R.H.)

5335 KAPL-M-CTW-2
Knolls Atomic Power Lab., Schenectady, N. Y.
CRYSTAL BAR HAFNIUM POWDER, ITS PRODUCTION, MECHANICAL AND CORROSION PROPERTIES. C. T. Waldo and W. Kermit Anderson. Jan. 10, 1957. 11p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Hafnium powder can be produced quite easily by the hydride process in much the same way as Zr. Specimens fabricated from Hf powder have poor ductility and a tensile strength of approximately 75,000 psi. The corrosion performance of fabricated powder metallurgy shapes in 680°F water is considered good on the basis of a 4000 hr exposure. (auth)

5336 NACA-RM-51D23
Michigan. Univ., Ann Arbor and Battelle Memorial Inst., Columbus, Ohio.
NOTES ON HEAT-RESISTANT MATERIALS IN BRITAIN FROM TECHNICAL MISSION, OCTOBER 13, TO NOVEMBER 30, 1950. J. W. Freeman and Howard C. Cross. May 14, 1951. 60p.

Summary of information on heat-resistant materials obtained from interviews with alloy producers, jet-engine manufacturers, and research laboratories in Britain during October and November 1950 is presented. Attention was directed to relationship between properties of materials and service requirements for gas turbines; to criterions used for judging and inspecting materials; and to research developments of both a practical and fundamental nature in the field. Some information is also included regarding ceramics, ceramals, and materials for high-temperature applications in steam-power plants. (auth)

5337 NACA-RM-51D23a
Michigan. Univ., Ann Arbor and Battelle Memorial Inst., Columbus, Ohio.
INFORMATION ON HEAT-RESISTANT MATERIALS IN BRITAIN FROM TECHNICAL MISSION, OCTOBER 13 TO NOVEMBER 30, 1950. J. W. Freeman and Howard C. Cross. May 14, 1951. 68p.

5338 NACA-TN-3332
Lewis Flight Propulsion Lab., Cleveland.
AN INVESTIGATION OF HIGH-TEMPERATURE VACUUM AND HYDROGEN FURNACE BRAZING. Walter E. Russell and John P. Wisner. Mar. 1957. 29p.

The vacuum and the hydrogen brazing of four heat-resistant alloys with two types of high-temperature brazing alloy were investigated. The effect of time at various brazing temperatures on the 1200°F shear strength of joints and on the base-metal tensile strength and elongation was also studied. Brazing techniques for alloys that can be age hardened and that contain titanium and aluminum in a vacuum as well as in dry hydrogen were evaluated. (auth)

5339 NMI-1142
Nuclear Metals, Inc., Cambridge, Mass.
CONSTRUCTION AND OPERATION OF A LABORATORY SCALE ARC MELTING UNIT. J. F. Kuchta and S. Isserow. Feb. 13, 1956. 19p. Contract AT(30-1)-1565. $0.20(OTS).

An arc melting unit was designed for laboratory use for rapid melting of pure metals or experimental alloys requiring higher temperatures than those readily obtainable in resistance-type furnaces. (J.E.D.)

5340 NMI-1161
Nuclear Metals, Inc., Cambridge, Mass.
ELECTRICAL THERMOELECTRIC HARDNESS, AND CORROSION PROPERTIES OF VANADIUM-BASE ALLOYS. H. J. Cleary. Sept. 5, 1956. 34p. Contract AT(30-1)-1565. $0.30(OTS).

Attempts have been made to find properties of V metal that make it suitable for industrial use and thereby increase the market for V which is now a by-product of U mining. Additions of 1 at. % Pd and other elements give V some unique properties in the super-conducting range that may lead to use of V in the cryotron, a new type electronic amplifier. A V alloy containing 25 at. % Al possesses high electrical resistivity (243 microhm-cm) at room temperature; however, this alloy has little ductility. Studies of the thermoelectric power and corrosion resistance of a number of V-rich alloys containing one atomic percent of a variety of elements revealed no striking or useful properties. (auth)

5341 NP-6242
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
DIRECTIONAL PROPERTIES IN TITANIUM AND TITANIUM ALLOYS. Jan. 31, 1957. 20p.

5342 NYO-7257
Carnegie Inst. of Tech., Pittsburgh. Lab. for Magnetics Research.
RESEARCH ON PROPERTIES OF RARE METALS. Final Report. J. E. Goldman. SUPPLEMENT I. THE HALL EFFECT IN TITANIUM, VANADIUM, CHROMIUM AND MANGANESE. Simon Foner. SUPPLEMENT 2. THE HALL EFFECT IN ZIRCONIUM AND HAFNIUM. Simon Foner. SUPPLEMENT 3. DEVELOPMENT OF CALORIMETRIC TECHNIQUES LEADING TO MEASUREMENTS ON ZIRCONIUM. George L. Guthrie. Aug. 31, 1956. 37p. Contract AT(30-1)-1596. $0.30(OTS).

The Hall effect in Ti, V, Cr and Mn was measured at room temperature with fields up to 30 kilo-oersteds. The Hall constant was positive for all of these elements. The effect is extremely small in Ti and apparently sensitive to small amounts of impurities. The results for these transition elements indicate that electrical conduction is predominantly due to hole conduction. Measurements of the Hall effect in Zr and Hf at room temperature show that the Hall constants are $+ 12.6 \times 10^{-13}$ v-cm/amp-gauss and $- 0.16 \times 10^{-13}$ v-cm/amp-gauss, respectively. The results indicate that there is an appreciable contribution of hole conduction to the electrical conductivity. (auth)

5343 TML-46A
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
DEPARTMENT OF DEFENSE TITANIUM SHEET-ROLLING PROGRAM. Status Report No. 1. C. R. Simcoe. Mar. 8, 1957. 41p.

The progress on the Department of Defense Titanium Sheet-Rolling Program for 1956 is summarized as follows: the progress reported by each of the titanium producers on their programs; the actions of the MAB Titanium Sheet-Rolling Panel and the various task forces of this panel; the plans of the Navy, Bureau of Aeronautics and the Air Force for Distributing and evaluating the alloys; and the results reported on several government contracts which are related to the sheet-rolling program. Detailed information is included on sheet sizes and gages, statistical sampling procedures, mechanical properties, and target reproducibility of mechanical properties. (auth)

5344 WADC-TR-55-458(Pt. II)
Cornell Aeronautical Lab., Inc., Buffalo.
RELAXATION BEHAVIOR OF TITANIUM ALLOYS. [Period covered] April 1, 1954 to January 31, 1956. Franklin J. Gillig. Nov. 5, 1956. 86p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2340. (AD-110673).

A relaxation test unit has been designed which provides practically continuous control of the total strain by automatically decreasing the load as the specimen tends to elongate due to creep. The unique feature of this equipment is the ability to apply the initial load in a matter of seconds so that very little relaxation occurs during loading. Relaxation tests have been made using this equipment for three Ti compositions: A-70, C-130AM, and A-110AT. The A-70 and A-110AT were heat treated to produce two different grain sizes and the C-130AM was heat treated to three different grain sizes. Relaxation tests were made on the three compositions in all of the microstructural conditions at room temperature, 600, and 800°F. The effect of grain size on relaxation characteristics was found to be much the same as in creep testing where the larger grain sizes possess greater resistance to deformation only at the higher test temperatures. (auth)

5345 WADC-TR-56-37
Minnesota. Univ., Minneapolis.
DAMPLING, ELASTICITY, AND FATIGUE PROPERTIES OF TITANIUM ALLOYS, HIGH TEMPERATURE ALLOYS, STAINLESS STEELS, AND GLASS LAMINATE AT ROOM AND ELEVATED TEMPERATURES. Period Covered: June 1952 to October 1955. E. R. Podnieks and B. J. Lazan. Mar. 1956. 92p. Project Title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task Title: FATIGUE PROPERTIES OF STRUCTURAL MATERIALS. Contract AF33(038)-20840. (AD-96137).

The significance of the damping, elasticity, and fatigue properties of a material on the resonant behavior of a part is reviewed. The basic unit for expressing damping energy and a procedure for its determination are discussed. Data on damping, elasticity, and fatigue properties at room and elevated temperatures are presented for four types of materials: titanium alloys, high temperature alloys, stainless steels, and glass fabric laminate. The general behavior of these dynamic properties is summarized with regard to the significance of the more important variables. The resonant fatigue properties in form of resonant fatigue curves are determined for several characteristic types of parts by using the above materials. A comparison is made for the materials under different design criteria. (auth)

5346 WADC-TR-56-220
Case Inst. of Tech., Cleveland.
EFFECTS OF PHYSICAL VARIABLES ON DELAYED FAILURE IN STEEL. Period [covered] March 31, 1955 to March 31, 1956. R. D. Johnson, H. H. Johnson, J. G. Morlet, and A. R. Troiano. Apr. 27, 1956. 43p. Project title: METALLIC MATERIALS. Task title: HIGH STRENGTH STEELS FOR AERONAUTICAL APPLICATIONS. Contract AF33(038)-22371. (AD-103038).

The effects of three specific variables, H distribution, test temperature, and prestressing, were determined on the H-induced brittle fracture of 4340 steel in static fatigue. An electrical resistance method was employed to measure the crack propagation characteristics in H-charged and aged specimens and in specimens which were prestressed prior to charging. Crack propagation in aged specimens

was sensitive to the H distribution but relatively independent of the applied stress for a given H distribution. Internal cracks were observed in aged specimens even in the presence of a sharp external notch. The temperature dependence of the rupture time indicated that the crack propagation was diffusion-controlled both in aged specimens and in specimens with an initial surface concentration of H. Prestressing prior to electrolytic charging with H tended to diminish the delayed failure phenomenon by elevating the stress range in which delayed failure occurred. (auth)

5347 WADC-TR-56-304
Mallory-Sharon Titanium Corp., Niles, Ohio.
THE EFFECT OF MICROSTRUCTURAL VARIABLES AND INTERSTITIAL ELEMENTS OF THE FATIGUE BEHAVIOR OR TITANIUM AND COMMERCIAL TITANIUM ALLOYS. [Period covered] April 1, 1955 to March 31, 1956. Charles B. Dittmar, G. William Bauer, and Dillon Evers. Oct. 1, 1956. 95p. Project Title: METALLIC MATERIALS. Task Title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2922. (AD-110726).

The effect of microstructure on the fatigue behavior of the commercial alloys Ti–5Al–2.5Sn, Ti–6Al–4V, and Ti–3Mn Complex has been investigated. Microstructure was found to have little effect on the endurance limit of these alloys unless the structure was extremely coarsened or embrittled. The effect of interstitial contents representative of the basis for commercial Ti specification, i.e., 0.07% N_2, 0.20% O_2, 0.20% C taken singly or grouped together, was investigated for unalloyed Ti and the commercial alloys Ti–5Al–2.5Sn, Ti–6Al–4V, and Ti–3Mn Complex. Titanium and the three Ti alloys investigated generally show increased or unchanged fatigue life at all of the interstitial contents specified above. (auth)

5348 WADC-TR-56-454
Climax Molybdenum Co. of Michigan, Detroit.
INVESTIGATION OF THE EFFECTS OF HOT-COLD WORK ON THE PROPERTIES OF MOLYBDENUM ALLOYS. Period Covered: April 1, 1955 to July 31, 1956. M. Semchyshen and Robert Q. Barr. Aug. 25, 1956. 125p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-2861. (AD-110708).

Molybdenum–0.28% niobium and molybdenum–0.50% titanium were investigated from the standpoint of effect of fabrication variables on the degree of strain hardening and the resultant mechanical properties and on subsequent resistance to softening with exposure to elevated temperatures. Fabrication was accomplished either by rolling or forging. Data are presented graphically and in tabular form and conclusions are summarized. (C.H.)

5349 WADC-TR-56-456
Dow Chemical Co., [Midland, Mich.]
CREEP BEHAVIOR OF MAGNESIUM ALLOYS. G. W. Pearsall and C. S. Roberts. Sept. 17, 1956. 33p. Project Title: METALLIC MATERIALS. Task Title: THE EFFECT OF COMPOSITION AND INTERNAL STRUCTURE ON THE PROPERTIES OF ALLOYS. Contract AF33(616)-2511. (AD-11072).

An orientation relationship was established between precipitate and matrix in a Mg–0.7 Ce alloy. The general creep behavior of Mg–Al and Mg–Th alloys was studied. The major effect of Al appeared to be intragranular strengthening while Th, in the form of a Mg–Th precipitate, hindered grain boundary migration. The effects of prestrain, preferred orientation and creep test interruption on creep behavior were also studied. The case of tertiary creep in sublimed Mg was investigated, using metallography and specific volume measurements. At 400°F, tertiary creep could be attributed either to cracking or intergranular cavitation, depending on strain rate. Tertiary creep was not observed at room temperature. A possible explanation for these observations is discussed. (auth)

5350 WAL-401/268
Watertown Arsenal Lab., Mass.
THE INFLUENCE OF FORGING TEMPERATURE ON MECHANICAL PROPERTIES OF Al–V TITANIUM ALLOYS. Leonard S. Croan and F. J. Rizzitand. Feb. 1957. O. O. Project Title: DEVELOPMENT OF HIGH-STRENGTH TOUGH TITANIUM ALLOYS.

An investigation to determine the effects of forging temperature on the mechanical properties after heat treatment of several heats of 6%Al–4%V and 7%Al–4%V Ti alloys was made. As a result of the study, a high-temperature production forging technique involving press forging from above the beta transus temperature and water quenching from the press was developed. Toughness, as measured by V notch Charpy impact resistance at –40°F, may be increased by as much as 50% without any significant effect on strength. Although a gradual loss in ductility results from the use of increasingly high forging temperatures, the loss is insignificant at the working temperatures recommended. By applying these techniques, advantages of improved forgeability, optimum combination of the more important mechanical properties, and reduced costs may be realized. The forging techniques developed have already been applied in processing more than 10,000 lb of closed-die forgings. (auth)

5351 RAE-Lib/Trans-554
CURRENT PROBLEMS OF THE METALLURGY OF TITANIUM. PART II. THE REDUCTION OF TITANIUM TETRACHLORIDE WITH MAGNESIUM. PART III. THE PRODUCTION OF TITANIUM BY FUSED SALT ELECTROLYSIS. (Aktuelle Probleme der Metallurgie des Titans. Teil II. Vorgange bei der Reduktion des $TiCl_4$ mit Magnesium. Teil III. Die Schmelzflusselektrolyse des Titans). W. J. Kroll. Translated by B. E. C. Jenkins from Metall 9, 366-76(1955). 31p. (AD-80097).

This paper includes parts II and III of a series of articles on the metallurgy of Ti. Part II deals with the production of $TiCl_4$ with Mg. In Part III the production of Ti by fused salt electrolysis is described. The ideal electrolytic cell is discussed, and the application of soluble anode techniques to the problem of Ti scrap is suggested. A number of references are given. (auth)

5352 TIB/T-4496
TITANIUM, ITS PROPERTIES, USES AND METHODS OF PRODUCTION. (Titan, Svoistva, Primenente i Metody Ego Polucheniya). Translated by I. I. Kornilov from Uspekhi Khim. 23, 529-46(1954). 21p. (AD-78071).

5353
THE EFFECT OF COMPOSITION ON THE STORED ENERGY OF COLD WORK AND THE DEFORMATION BEHAVIOR OF GOLD–SILVER ALLOYS. P. Greenfield and M. B. Bever (Massachusetts Inst. of Tech., Cambridge). Acta Met. 5, 125-30(1957) March.

The energy stored in chips formed by drilling at room temperature and at –195°C has been determined for five Ag–Au alloys in the composition range from 35 to 98 at.% Au. The stored energy varies with composition by a factor of nearly 5 at room temperature and by nearly 3 at –195°C. The stored energy also varies with the temperature of deformation and, after working at –195°C, is approximately two to five times as large as after working at room temperature. The energy expended in the deformation is larger at the lower temperature, and increases with increasing

concentration of solute. Only about 1% of this energy is stored. (auth)

5354

THE QUENCHING-IN OF LATTICE DEFECTS IN GOLD–CADMIUM. M. S. Wechsler (Oak Ridge National Lab., Tenn.). Acta Met. 5, 150-8(1957) March.

When beta Au-Cd is quenched from a high temperature, a large increase in resistivity results. The amount of quenched-in resistivity was measured as a function of quench temperature and an energy of formation of 0.38 ev was obtained for the associated defects. The isothermal annealing of the quenched-in resistivity was studied at a number of temperatures. The process appears to have an incubation period and an activation energy for motion of 0.58 ev. Possible explanations are discussed; the quenching-in of lattice vacancies is considered to be the most likely source of the effect. On the basis of Jongenburger's theoretical estimates of the resistivity arising from vacancies in Au, it is estimated that about 0.7% vacancies are frozen in after quenching from 450°C. (auth)

5355

DISSOLUTION OF THE OXIDE FILM ON ZIRCONIUM. R. D. Misch (Argonne National Lab., Lemont, Ill.). Acta Met. 5, 179-80(1957) March.

5356

WELDING TECHNIQUES IN ATOMIC ENERGY PLANTS. I. H. Hogg (U.K.A.E.A. Industrial Group H.Q., Risley). Atomics 8, 77-82, 99(1957) March.

Methods are presented of welding procedures used in the construction of various atomic energy plants by the U.K.A.E.A. (W.L.H.)

5357

LIQUID METALS—2 AND NUCLEAR POWER. C. D. Boadle (Rolls-Royce Ltd., Derby). Atomics 8, 83-5, 106 (1957) March.

Advantages and disadvantages of liquid metals for high-temperature heat extraction from nuclear reactors are discussed. (W.L.H.)

5358

DIFFUSION AND OXIDATION OF METALS. Massoud T. Simnad (General Dynamics Corp., San Diego, Calif.). Ind. Eng. Chem. 49, 617-26(1957) March.

A review is presented which includes theory of diffusion, volume self diffusion, chemical diffusion in substitional alloys and interstitial alloys, grain boundary and surface diffusion, and oxidation of metals and alloys. 361 references. (T.R.H.)

5359

THE STABILITY OF MECHANICAL PROPERTIES OF BETA-PHASE MAGNESIUM–LITHIUM ALLOYS. W. R. D. Jones and G. V. Hogg (Univ. Coll., Cardiff). J. Inst. Metals 85, 255-61(1957) Feb.

It has been shown that when Al, Zn, Cd is added to binary Mg–Li alloys, good mechanical properties in the cast and rolled conditions are obtained which compare very favorably with those of other light alloys having a higher density. These alloys, however, suffer from the great disadvantage that their mechanical properties are not stable at ordinary temperatures. Attempts have now been made to decrease this instability by adding varying amounts of Ag, Cu, Cd, Al, Sn, Sb, or Ni to three basic β-phase ternary alloys. The results suggest that the instability of mechanical properties may be connected with electron concentration. Lowering the electron concentration by suitable additions, or by increasing the Li content, decreased the instability. Silver (univalent) proved to be the most effective addition. Raising the electron concentration by the addition of Sb increased the instability. Microscopic and x-ray examination showed the influence of an alteration of the electron concentration on the existence of phases which affect the stability of mechanical properties. Even though alloys containing Ag or Cu are not permanently stable above 16° C, the mechanical properties after ageing for 200 hr at 75° C. are nevertheless encouraging. (auth)

5360

DISPERSED HARD PARTICLE STRENGTHENING OF METALS. Nicholas J. Grant and Oliver Preston (Massachusetts Inst. of Tech., Cambridge). J. of Metals 9, 349-57(1957) March.

A review is presented of the various methods utilized to strengthen metals and alloys for high temperature service by a suitable dispersion of finely divided hard particles. Alloys such as SAP, produced by powder metallurgy, and other sintered Al powders, Mo containing small quantities of refractory oxides and Mg containing a dispersed intermetallic, are considered. Internal oxidation and other methods of achieving a hard particle dispersion are discussed. New data on the high temperature strength and stability of the alloy systems Cu–Al_2O_3, Ni–Al_2O_3 and Be–Be_2C are shown. The theoretical aspects of the hardening and strengthening mechanism are presented and consideration is given to the problems associated with the powder metallurgy of the various processes. (auth)

5361

LIQUID IMMISCIBILITY IN METAL SYSTEMS. B. W. Mott (Atomic Energy Research Establishment, Harwell). Phil. Mag. (8) 2, 259-83(1957) Feb.

An analysis is made of liquid immiscibility in metal systems. It is shown that the simple Hildebrand rule, which holds for non-polar liquids, can be modified to apply to metal systems, by the introduction of a new term which allows for the increased energy due to a difference in electronegativity of the components. The electronegativity term involves the maximum number of bonds which can form between two given metals, and is considered to be a function of their relative atomic sizes. On the theory suggested, out of a total of 529 alloy systems considered, 426 can be accounted for compared with 312 on the simple Hildebrand rule. Of the exceptions, several can be explained on the basis of errors in the calculation of the energy factors involved, and others can be brought into agreement on the assumption that the electronegativities of some specified elements vary with the elements with which they are alloyed. The application of the modified hypothesis to ternary systems is discussed. (auth)

5362

HEAT TRANSFER AND THERMOPHYSICAL PROPERTIES OF MOLTEN ALKALI METALS. I. I. Novikov, A. N. Solovyev, E. M. Khabakhpasheva, V. A. Gruzdev, A. I. Pridantsev, and M. Ya. Vasenia. Soviet J. Atomic Energy 4, 545-60(1956).

An investigation was undertaken of heat transfer to molten sodium during turbulent flow in a round copper or nickel tube. An interpolation formula was obtained. Experiments were conducted to determine thermal resistance between liquid sodium and a solid wall of copper, nickel, and stainless steel. Methods were developed for measurement of viscosity, temperature conductivity and density of molten metals. Results are given for measurements of these physical parameters for molten alkali metals (sodium, potassium, lithium and the eutectic solution of sodium and potassium) in a broad interval of temperatures. (auth)

PHYSICS

5363 AD-78981

Picatinny Arsenal. Samuel Feltman Ammunition Labs., Dover, N. J.

DETERMINATION OF THE PARTICLE SIZE AND DISTRIBUTION OF SUB-SIEVE POWDERS. Research and Development Lecture No. 13. Bernard Dubrow. Mar. 1955. 19p.

Analysis is presented of the current trends in the measurement of the particulate properties of fine powders. Three quantities which were determined to be of value are size distribution, specific surface, and particle shape. Instruments are described for determining particle size distribution of materials in the subsieve range. The techniques include centrifugal air elutriation, liquid sedimentation, and air sedimentation. The air permeability and gas absorption methods were considered useful for determining the specific surface of a powder without regard to its actual size distribution. (auth)

5364 AECU-3419

Los Alamos Scientific Lab., N. Mex.

DENSITY OF BASIC ROCKS AT VERY HIGH PRESSURES. Darrell S. Hughes and Robert G. McQueen. [1956 ?]. 21p. Contract [W-7405-eng-36]. $4.80(ph OTS); $2.70(mf OTS).

The density of two gabbros and one dunite was measured at several pressures in the range from 150 to 750 kilobars. (1 kilobar = 986.2 atmospheres.) These pressures were attained in shock fronts generated by high explosives. The densities were computed from the observed shock waves. The dunite, initial density of 3.25 g/cc, was compressed to a density of about 4.9 g/cc at 720 kilobars. The gabbros, initial density 3.0 g/cc, were compressed to 5.0 g/cc at 750 kilobars. Both gabbros show evidence of a polymorphic transition at some pressure around 150 kilobars to a more dense, but less compressible phase. The agreement obtained from these data with a crust of dunite 400 km thick underlain by a gabbroic rock with Bullen's Model A is very close. (auth)

5365 AECU-3423

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

PROGRESS REPORT NO. 42 [FOR] PERIOD JUNE 1, 1956 THROUGH AUGUST 31, 1956. Aug. 31, 1956. 87p. Contracts AT(30-1)-905 and Nonr-1841(16). $13.80(ph OTS); $4.80(mf OTS).

Research is reported in the chemistry of the fission elements, nuclear chemistry (organic and inorganic), cosmic rays, elementary particle scattering, particle acceleration, and radioactivity. (T.R.H.)

5366 AERE-GP/M-195

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME MEASUREMENTS OF THE MAGNETIC FIELD PRODUCED BY RIDGED POLE PIECES. P. F. Smith. Nov. 1956. 18p.

Some measurements have been made of the field distribution arising from straight, parallel, ridges of rectangular cross-section on the poles of a magnet. The quantities "mean gap" and "magnetic field flutter" are defined, and are tabulated for 14 systems of ridges, at mean fields between 8 kilogauss and 20 kilogauss. This account is confined to the cases in which the ridge width is half the distance between successive ridges. Some theoretical calculations are compared with the experimental results, and some preliminary measurements on sector-shaped ridges are also described. (auth)

5367 CF-57-3-50

Oak Ridge National Lab., Tenn.

IN-PILE SLURRY LOOP PROGRAM. T. A. Arehart, E. L. Compere, D. E. Ferguson, R. B. Korsmeyer, and J. P. McBride. Mar. 8, 1957. 15p. Contract [W-7405-Eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The in-pile slurry loop work is now being considered as a joint program between the PAR project and ORNL. The major objectives of this program are to determine the effect of irradiation on rate of attack by circulating ThO_2 slurries on metals of reactor interest; to determine the effect of irradiation on physical and chemical properties of circulating ThO_2 slurries; and to test gas recombination catalysts under reactor conditions. (W.L.H.)

5368 LA-2110

Los Alamos Scientific Lab., N. Mex.

THE THERMODYNAMIC PROPERTIES OF 54 ELEMENTS CONSIDERED AS IDEAL MONATOMIC GASES. Harwood G. Kolsky, Ruth M. Gilmer, and Paul W. Gilles. Dec. 20, 1956. 138p. Contract W-7405-eng-36. $0.70(OTS).

5369 NP-6236

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

QUARTERLY PROGRESS REPORT NO. 44 FOR PERIOD ENDING NOVEMBER 30, 1956. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. Jan. 15, 1957. 168p. DA Projects 3-99-10-022 and 3-99-10-000. Contract DA36-039-sc-64637.

Preliminary results are reported on the thermionic emission from a planar molybdenum crystal and the equilibrium characteristics of a modified Bayard-Alpert ionization gage. Plasma research was directed towards the study of the effects of boundary sheaths on plasma oscillations. Studies were also made of the effect of the nonuniformity of the breakdown field on the microwave breakdown and of the properties of the pulsed breakdown. Conditions for maintaining a highly ionized hydrogen plasma were studied. Diagrams are given of a molecular-beam microwave spectroscope. The interrelations of the magnetic sublevels of hyperfine-structure lines and intermediate coupling in nuclear resonance spectra are briefly discussed. The limiting noise figure of a microwave tube is also discussed in some detail. A discussion of the gain-phase characteristics of multicavity klystrons is included. Various phases of statistical communication theory are also discussed in detail. Research is also reported on process analysis and synthesis and the processing and transmission of information. Noise in electron devices is also discussed. Studies were also continued on communications biophysics. The limitations of amplifying devices are discussed. Network synthesis and microwave theory are also briefly discussed. (For preceding period see NP-6155.) (B.J.H.)

5370 NYO-6333

Pittsburgh. Univ.

A COMPARISON OF PYCNOMETRIC AND X-RAY DENSITIES FOR THE SODIUM CHLORIDE–SODIUM BROMIDE AND POTASSIUM CHLORIDE–POTASSIUM BROMIDE SYSTEMS. Progress Report for July 1, 1956 to October 1, 1956. W. E. Wallace and John S. Wollam. Oct. 8, 1956. 9p. Contract AT(30-1)-647. $0.15(OTS).

(For preceding period see NYO-6332.)

5371 OSR-TN-56-69

Stanford Research Inst., Menlo Park, Calif.

THEORETICAL CONSIDERATIONS ON PERFORMANCE CHARACTERISTICS OF SOLAR FURNACES. Technical Report No. I. (Report No. 3). Eugene Loh, Pol Duwez, Nevin K. Hiester, and Thomas E. Tietz. Jan. 16, 1956.

31p. SRI Project No. CU-1410. Contract AF18(600)-1499. (AD-81521).

A theoretical discussion of the parabolic-type solar furnace is presented. Calculations of the heat flux and the maximum temperature obtainable at the focus are presented for furnaces of different diameter-to-focal-length ratios. The analysis is extended to the California Institute of Technology lens-type furnace. The calculations indicate that the upper practical limit of a parabolic furnace has a rim angle θ of 50 to 60° or a diameter-to-focal-length ratio of about 2.0. Above a rim angle of 60° there is very little increase in the maximum temperature obtainable at the focus. In addition, the difficulty of constructing an accurate parabolic surface increases with increasing rim angle. The results indicate that a paraboloid of relatively low quality is capable of achieving temperatures over 2000°K with a low heat flux of about 20 cal/sec/cm^2. On the other hand, a research furnace capable of attaining temperatures in the range of 3600 to 4200°K, or a furnace capable of high heat flux values above 230 cal/sec/cm^2, would have to have a paraboloid of very high quality. (auth)

5372 TIB/T4520

THE STABILITY OF SLOW DETONATIONS. (Die Stabilität Langsamer Detonationen.) R. Schall. Translated from Z. angew. Phys. 6, 470-5(1954). 14p. (AD-92159).

The stability of detonation waves with incomplete reaction is investigated. Consideration of the structure of the reaction zone shows that such waves can only be stable if the reaction is either practically confined within the Chapman-Jouguet surface or is only very incomplete. Assuming that, where the energy released is small, air bubbles are effective as explosion nuclei, in the case of fluid explosives, the velocity of detonation can be stated in terms of the length of the reaction zone, using the reaction velocities calculated by Behrens. The hypothesis of a plausible propagation mechanism with the length of the reaction zone of the degree of magnitude of the mean distance between effective nuclei shows the detonation velocity in terms of the density of the nuclei. With nitroglycerine, where in certain cases the distance between the nuclei can be determined, the agreement with the measured velocities is satisfactory. (auth)

5373

MASS TRANSFER. C. R. Wilke and John M. Prausnitz (Univ. of California, Berkeley). Ind. Eng. Chem. 49, 577-82(1957) March.

A review is presented on mass transfer. Molecular diffusion, turbulent diffusion, diffusion and convection, interfacial resistance, transfer between two liquid phases, solids, and diffusive separations are the sub-topics considered. 73 references. (T.R.H.)

5374

NUCLEAR PROCESSES IN GEOLOGIC SETTINGS. PROCEEDINGS OF THE SECOND CONFERENCE, PENNSYLVANIA STATE UNIVERSITY, SEPTEMBER 8-10, 1955. Washington, National Academy of Sciences–National Research Council, 1956. 210p.

Papers are included on the presence of H_2O in tektites, the determination of He isotope abundance ratios, the oxygen isotope cycle in nature, variations of the O^{18}/O^{16} ratios of fresh waters and ice, the isotopic geochemistry of thermal waters, variations in the nitrogen isotope abundance, sulfur isotope abundances in sulfide materials, the isotope reference sample program at NBS, leakage of U and Pb and the measurement of geological time, interpretation of lead ages by acid washing experiments, radiation damage and age measurements in zircons, the age of meteorites by the Rb^{87}–Sr^{87} method, the U content of two Fe meteorites, the isolation and isotopic analysis of Pb in meteorites and rocks, the potassium argon age method, Rb–Sr and K–Ca analyses and ages, the evaluation of mineral age measurements, oxygen isotope variations in U minerals, the distribution of artificially produced T in nature, chlorine-36 in nature, the half lives of Th^{232} and Rb^{87}, the branching ratio of Bi^{212}, and the decay of Ta^{180}. (B.J.H.)

5375

KRYPTON-85 SOURCE IMPROVES INDUSTRIAL THICKNESS GAGES. W. Everett Swift (Foxboro Co., Mass.). Nucleonics 15, No. 3, 66-7(1957) March.

The advantages of Kr^{85} sources over two other sources for use in industrial thickness gages are presented. (W.L.H.)

5376

IRRADIATION COLOURS AND LUMINESCENCE. Karl Przibram. London, Pergamon Press Ltd. 1956. 345p.

A survey has been attempted of the present state of research on color centers and, with it, the related luminescence. It has shown that the criteria set up for a natural coloration due to radiation are fulfilled for a whole series of minerals, as well as establishing that luminescence phenomena are often due to a radioactive effect in nature. (W.L.H.)

5377

THERMAL FLUCTATIONS IN CONDUCTORS. Nandor L. Balazs (Univ. of Chicago, Ill.). Phys. Rev. 105, 896-9 (1957) Feb. 1.

The behavior of a conductor in thermal equilibrium with the surrounding radiation field is investigated. An expression is obtained connecting the spectrum of the current fluctuations with the absorption. For small frequencies this reduces to Nyquist's relation. For large frequencies, however, the relation is quite different; namely, the current fluctuations are proportional to the (skin) resistance and depend also on the shape of the conductor. (auth)

AEROSOLS

5378 COO-1016

Illinois. Univ., Urbana. Engineering Experiment Station. BIBLIOGRAPHY ON AEROSOLS, 1950-1955. Supplement to Report SO-1003. W. J. Scheffy, comp. June 1, 1956. 117p. Contract AT(11-1)-276. $0.60(OTS).

ASTROPHYSICS

5379

NUCLEAR REACTIONS WITH THE NEON ISOTOPES IN STARS. Jerry B. Marion and William A. Fowler (California Inst. of Tech., Pasadena). Astrophys. J. 125, 221-32(1957) Jan.

New calculations, based on recent experimental information have been made of the reaction rates of the $Ne^{20}(p,\gamma)Na^{21}$, $Ne^{21}(p,\gamma)Na^{22}$, $Ne^{22}(p,\gamma)Na^{23}$, and $Ne^{21}(a,n)Mg^{24}$ reactions as a function of stellar temperature. A method of obtaining the reduced nucleon widths of mirror levels is given which is probably accurate to within a factor of 2 and has been used in the calculation of the $Ne^{20}(p,\gamma)Na^{21}$ reaction rate. The results of these computations indicate that appreciable quantities of Ne^{21}, formed by the reactions $Ne^{20}(p,\gamma)Na^{21}(\beta^+)Ne^{21}$, cannot be produced in the presence of C and N, since these latter elements convert all the H into He before the slower $Ne^{20}(p,\gamma)Na^{21}$ reaction can take place. It appears, however, that in red giant stars in which O^{16} and Ne^{20} but not C^{12} are originally present in the envelope, Ne^{21} may be formed in sufficient amounts to allow the $Ne^{21}(a,n)Mg^{24}$ reaction to be the source of an adequate number of neutrons for heavy-element synthesis as the He-burning core develops.

Further experimental measurements on the $O^{16}(p,\gamma)F^{17}$ reaction and on various He interactions will be required to settle the matter. (auth)

COSMIC RADIATION

5380

TIME VARIATIONS OF PRIMARY COSMIC RAYS. V. Sarabhai and N. W. Nerurkar (Physical Research Lab., Ahmedabad, India). Ann. Rev. Nuclear Sci. 6, 1-42(1956).

Particular emphasis is placed on advances made from 1952 through 1955. Consideration is first given to advances made in various other fields which provide background for studies of cosmic ray time variations. These include studies of geomagnetic effects, atmospheric diffusion of cosmic rays, variations in atmospheric origin and anisotropy of primary cosmic radiation. Time variations of cosmic radiation are then discussed, including both long range and short term changes. A description is also included of the solar flare effect. The interpretation of the variations is next discussed, with particular reference to their dependence on the mean energy of primaries and to their solar and terrestrial relationships. Brief discussions are included on the interpretation of the solar anisotropy of cosmic radiation and on implications on theories of the origin of cosmic rays. 116 references. (B.J.H.)

5381

ENERGY LOSS OF A CHARGED PARTICLE TRAVERSING IONIZED GAS AND INJECTION ENERGIES OF COSMIC RAYS. Satio Hayakawa (Kyoto Univ.) and Kazuo Kitao (Osaka City Univ.). Progr. Theoret. Phys. (Japan) 16, 139-48(1956) Aug.

The energy loss of a charged particle traversing an electron gas is calculated by taking the direct collisions with free electrons and the plasma excitation into account. The contributions from ions and neutral atoms are added and the resultant energy loss is given as a function of the degree of ionization. The energy loss is found to increase with the degree of ionization, to which excess loss is approximately proportional. The critical injection energy of cosmic rays, based on the Fermi mechanism of acceleration, is given. Its value is about fifty percent larger for the degree of ionization of ten percent than for a neutral medium and nearly four times larger for a half ionized medium. In the case of the solar production of cosmic rays the critical injection energy is below one Mev per nucleon, so that the secondary particles generated by nuclear reactions could be accelerated to cosmic ray energies. The mechanism of acceleration in a coronal region is proposed in the appendix to explain the time delay of the cosmic ray increase compared with the solar eruption as well as the energy spectrum of solar cosmic rays. (auth)

5382

THE ATMOSPHERIC EFFECTS OF THE INTENSITY OF HIGH ENERGY μ-MESONS. Takashi Murayama, Kazuaki Murakami, Ryokichi Tanaka, and Shuzo Ogawa (Nagoya Univ.). Progr. Theoret. Phys. (Japan) 15, 421-30(1956) May.

In order to reconsider the present model of the cosmic ray in middle energy region, calculations are made for the atmospheric effects on the oblique intensity of high energy μ mesons under the following assumptions: (1) The π mesons; (2) The source function of these π mesons decreases exponentially with an atmospheric depth. Zenithal dependence and the absolute intensity of the μ mesons at sea level deduced theoretically are compared with a narrow angle counter telescope experiment by Sekido, Yoshida and Kamiya. Satisfactory accordance seems to suggest the consistency of the present assumptions. Correlation coefficients of the temperature effect are also obtained on the oblique μ mesons. It is shown that the negative temperature effect can be mainly attributed to the variation of the height of μ meson production, but is partly dependent on the variation of the density distribution of the air. The correlation coefficients of the temperature effects on the vertical μ meson are also compared with the experimental results of Duperier. (auth)

5383

TRANSITION EFFECT OF COSMIC RAYS IN Pb UNDER SPECIAL CONSIDERATION OF HARD COMPONENTS. H. Burmeister. Z. Naturforsch 12a, 10-18(1957) Jan. (In German)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5384 NYO-7302

New York Univ., New York. Coll. of Engineering.
ORIGIN OF RECRYSTALLIZATION NUCLEI. Summary Technical Report for the Period October 1954 to October 1956. L. P. Stone, J. P. Nielsen, and Y. C. Liu. Nov. 1956. 24p. Contract AT(30-1)-1754. $4.80(ph OTS); 2.70(mf OTS).

A summary is presented of the types of experiments which have been performed in the field of grain growth. On the basis of this prior work, the general principles which have been experimentally substantiated are presented. Direct observation of the growth process in two-dimensional grain networks is very difficult, if not impossible, under the condition of constant temperature and in the absence of stress and prior strain. Two alternate approaches to the growth process are presented. (auth)

5385 UCRL-3641

California. Univ., Berkeley. Radiation Lab.
THE CRYSTAL STRUCTURE OF ACETIC ACID. Robert E. Jones. Dec. 14, 1956. 19p. Contract W-7405-eng-48. $0.20(OTS).

The crystal structure of acetic acid was determined using x-ray diffraction techniques and a least squares method of refinement. The molecules are planar within experimental error and, except for the single-bond C-O distance which is shortened to 1.29 A, the bond lengths were found to be in agreement with previous determinations in the gas phase by electron diffraction and infrared spectroscopy. The molecules are linked together by hydrogen bonds in the infinite chains similar to the structure of crystalline formic acid. It appears that van der Waals forces can account for the adhesion between chains. (auth)

5386 AEC-tr-2847

THE MODEL AND ASSUMPTIONS USED IN THE CALCULATION OF THE RATE OF EVAPORATION. O. Knacke. Translated by M. H. Rand from Z. physik. Chem. 198, 159-66(1951). 7p.

Evaporation from the surface of a crystal is considered. (T.R.H.)

5387

SIGN OF THE CRYSTALLINE CUBIC FIELD SPLITTING PARAMETER a IN AN S STATE. W. Low (Univ. of Chicago, Ill.). Phys. Rev. 105, 792-3(1957) Feb. 1.

Measurements of the paramagnetic resonance spectrum of manganese and ferric ions at low temperatures yield the values for the cubic field splitting parameter a as 18.6×10^{-4} and 205×10^{-4} cm^{-1} respectively. The sign of a is positive in both cases, indicating that the twofold degenerate level is lower than the four-fold degenerate level. This

is in contrast with Bleaney and Trenam's results on ferric alums who find a negative a. For gadolinium in CaF_2, the constant $a = 175 \times 10^{-4}$ cm^{-1} and is also positive. (auth)

5388

X-RAY AND NEUTRON DIFFRACTION STUDY OF ANTIFERROELECTRIC LEAD ZIRCONATE, $PbZrO_3$. F. Jona, G. Shirane, F. Mazzi, and R. Pepinsky (Pennsylvania State Univ., University Park). Phys. Rev. 105, 849-56(1957) Feb. 1.

The room-temperature structure of antiferroelectric lead zirconate, $PbZrO_3$, has been studied by x-ray and neutron diffraction. The symmetry is orthorhombic (pseudotetragonal) with lattice parameters a = 5.88 A, b = 11.77 A, c = 8.22 A. The space group is Pba2 and there are 8 formula units in the unit cell. The structure results from slight distortions of the cubic perovskite lattice, which the crystal assumes above 230°C. With respect to the ideal perovskite structure, Pb atoms suffer antiparallel shifts along the former cubic [110] direction; oxygen atoms also suffer antiparallel shifts within the (001) plane and, in addition, unbalanced antiparallel shifts along the c direction. The noncentric symmetry is in accord with the presence of a small piezoelectric effect as reported by Roberts. The oxygen octahedra surrounding the Zr atoms appear to be distorted, and it is possible to explain the strong optical anisotropy within the (001) plane as well as the pseudotetragonality (b = 21). (auth)

5389

NEUTRON DIFFRACTION STUDY OF ORTHORHOMBIC $BaTiO_3$. G. Shirane, H. Danner, and R. Pepinsky (Brookhaven National Lab., Upton N. Y. and Pennsylvania State Univ., University Park). Phys. Rev. 105, 856-60(1957) Feb. 1.

The atomic positions of ferroelectric $BaTiO_3$ in its orthorhombic phase have been determined by a single-crystal neutron-diffraction analysis. Pillar-shaped crystals with their major axes along the cubic [110] direction were maintained as single domains by the application of an electric field. The structure deduced can be viewed as a framework of slightly distorted oxygen octahedra, in which the central Ti ions are displaced towards one of the octahedron edges (polar axis) by 0.13 A. The Ba ions are also shifted in the same direction but by the smaller amount of 0.07 A. A comparison of this structure with that of the tetragonal phase suggests the essential role of Ti in the ferroelectricity of this crystal as treated by Slater. (auth)

ELECTRICAL DISCHARGE

5390 NP-6217

ELECTRON ACCELERATION AGAINST AN OPPOSING ELECTRIC FIELD. Joseph Slepian. [1957]. 3p.

5391 NYO-3724

Princeton Univ., N J. Project Matterhorn.

THE EFFECT OF SHIELDING ON THE FIELDS OF CERTAIN CURRENT DISTRIBUTIONS. Technical Memorandum No. 11. Martin D. Kruskal. Nov. 4, 1953. 6p. Contract AT(30-1)-1238. $1.80(ph OTS); $1.80(mf OTS).

5392 NYO-7887

Princeton Univ., N. Y. Project Matterhorn.

ELECTRON OSCILLATIONS IN A MAGNETIC FIELD. Technical Memorandum No. 13. William A. Newcomb. Dec. 14, 1954. 13p. $3.30(ph OTS); $2.40(mf OTS).

Previous equations for describing electronic plasma oscillations in a homogeneous magnetic field were based on an application of the Boltzmann equation. The complexity of these equations led to a simpler but less accurate treatment of electron oscillations in which thermal motions are neglected. A zero plasma temperature is assumed, making it necessary to use the Boltzmann equation. The zero temperature treatment yields a simple dispersion formula which gives approximate values for the characteristic frequencies of the plasma. The correction terms which would arise from thermal motions are small. (D.E.B.)

5393 TID-3506

Technical Information Service Extension, AEC.

UNCLASSIFIED U. S. ATOMIC ENERGY COMMISSION REPORTS ON CONTROLLED THERMONUCLEAR PROCESSES. A LITERATURE SEARCH. Sidney F. Lanier, Comp. Jan. 1957. 7p. $0.10(OTS).

5394 AEC-tr-2837

ELECTRIC "MICRODISCHARGES" IN THE DYNAMICAL VACUUM. Robert Arnal. Translated from Ann. phys. (12) 10, 830-73(1955). 49p.

The electric microdischarges preceding sparks in a vacuum were investigated in the ranges 3 to 40 mm electrode separation, 10^{-4} to 10^{-3} mm Hg pressure, and 50 to 140 kv potential. A cascade type of discharge formed by charged particles produced by secondary emission is indicated. The particles making up the discharge appear to be electrons and H^- and H^+ ions; the H ions originating at the anode. (D.E.B.)

5395 AEC-tr-2849

EMISSIVE DISTURBANCE OF THERMODYNAMICAL EQUILIBRIUM IN A PLASMA. L. M. Biberman. Translated from Zhur. Eksptl'. i Teoret. Fiz. 19, 584-90(1949). 10p.

The departure of a plasma from its equilibrium state is studied due to the emission of radiation. The distribution of excited states is obtained as a function of the coordinates for small deviations from equilibrium. The decline of the concentration of excited states toward the source boundary, even at assumed constant temperature, results in self-reversal of emission lines when the source is small and in the appearance of absorption lines when the source occupies a half-space. (auth)

5396

THE COLLECTION OF POSITIVE IONS BY A PROBE IMMERSED IN A PLASMA. J. E. Allen and P. Reynolds (Atomic Energy Research Establishment, Harwell, Berks) and R. L. F. Boyd (Univ. Coll. London). Proc. Phys. Soc. (London) B70, 297-304(1957) March.

The theory of the collection of positive ions by a probe immersed in a low pressure plasma is reviewed and extended. The ion current is determined mainly by the electric field which penetrates beyond the sheath edge into the plasma. Computed potential distributions for a spherical probe are presented, together with the calculated positive ion current–voltage characteristics. (auth)

5397

NONLINEAR THEORY OF LONGITUDINAL PLASMA OSCILLATIONS. R. V. Polovin (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 290(1957) March.

ELECTRONS

5398

THE MULTIPLE SCATTERING OF POSITRONS AND ELECTRONS. C. Henderson and A. Scott (Univ. Coll. London). Proc. Phys. Soc. (London) A70, 188-94(1957) March.

The multiple scattering of electrons and positrons at an energy of 0.4 Mev has been measured with a scintillation counter. The difference between the distribution width for

electrons and that for positrons after scattering by aluminum, silver and gold is smaller than previous measurements have indicated, and is given approximately by the calculations of Mohr. Further work with electrons only, using silver and Ilford G5 emulsion as the scattering foil material shows good agreement with the theory of Molière. (auth)

5399

THE LATERAL DIFFUSION OF AN ELECTRON SWARM IN A MAGNETIC FIELD. R. J. Bickerton (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) B70, 305-13 (1957) March.

The lateral spreading of a swarm of electrons moving through a gas in parallel electric and magnetic fields is measured. Currents of between 10^{-5} and 10^{-10} ampere are passed through helium, neon and hydrogen at pressures of the order 1 mm Hg. Agreement with theory is found for the influence of the magnetic field on the diffusion and mobility of the electrons. The effects of space charge and of secondary processes can also be predicted quantitatively. (auth)

5400

COULOMB INTERACTIONS AND THE DIAMAGNETISM OF FREE ELECTRONS. Hideo Kanazawa (Univ. of Tokyo). Progr. Theoret. Phys. (Japan) 15, 273-93(1956) March.

The effect of the long-range part of the Coulomb interactions on the Landau diamagnetism is investigated, applying the collective description of the Coulomb interactions developed by Bohm and Pines. It is shown that the magnitude of the diamagnetic susceptibility slightly increases due to the Coulomb interactions between electrons. (auth)

5401

INTERACTION BETWEEN ELECTRONS IN TWO-DIMENSIONAL FREE-ELECTRON MODEL FOR CONJUGATED SYSTEMS. Sigeru Huzinaga (Kyoto Univ.). Progr. Theoret. Phys. (Japan) 15, 495-500(1956) May.

An attempt is made to include the effects of electron-electron interactions into the two-dimensional free-electron model of Platt for conjugated systems. The method is explained in the case of the naphthalene molecule as a simple example. The excitation energies of the first four singlets are calculated. The agreement between theory and experiment is moderate. The method may be applied to larger systems with reasonable amount of labor, to which the applications of the usual theories based on atomic orbitals may not be feasible. (auth)

GASES

5402 AECU-3422

Nebraska. Univ., Lincoln.

STUDY OF SECONDARY ELECTRONS IN GASES. Chris E. Kuyatt. [1957]. 14p. Contract AT(11-1)-35. $4.80(ph OTS); $2.70(mf OTS).

The equipment developed and assembled for the study of secondary electrons in gases is described. A proton beam from a Cockcroft-Walton accelerator is modulated at 60 cps. and a proportional part of it is deflected to a Faraday chamber. The transmitted beam passes to a scattering chamber where a known volume is observed with an electron extraction port. The extraction beam is analyzed by a 127° cylindrical, electrostatic analyzer and detected by appropriate apparatus. No scattering measurements have as yet been made. (T.R.H.)

5403 AERE-I/R-1653

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EXTRACTION, PURIFICATION AND INDUSTRIAL USES OF KRYPTON-85. E. J. Wilson, C. Evans, J. Chadwick, J. Eakins, and K. J. Taylor. Apr. 25, 1955. Decl. Jan. 9, 1957. 18p.

5404 K-1302(Pt. III)

Oak Ridge Gaseous Diffusion Plant, Tenn.

THE PROBLEM OF KNUDSEN FLOW. PART III. SOLUTIONS FOR ONE-DIMENSIONAL SYSTEMS. W. C. DeMarcus. Mar. 19, 1957. 51p. Contract W-7405-eng-26. $7.80(ph OTS); $3.30(mf OTS).

A systematic discussion of the Knudsen Flow problem for one-dimensional systems is presented. Most of the analysis is directed toward those particular one-dimensional systems for which the kernel function of the integral equation is of the displacement type. The right circular capillary, a pair of semi-infinite parallel plates, and a highly dispersed bed of isotropically scattering spheres all fall into this category. It is shown that a systematic application of the principle of detailed balancing, the ergodic theorem and an invariance principle discloses that all the functions necessary for the complete description of the Knudsen Flow can be found from any one of these functions. The relations thus disclosed between the various functions are then employed to obtain two other integral equations. One of these "almost" yields the solution for the cases of the long capillary tube and thick bed of spheres without solving the integral equation. The derivations of the analytic forms of the integral equations describing Knudsen Flow for the three cases mentioned are carried through and estimates of the transmission probability are made via the variational method. These values are given in tabular form. An interesting by-product for the case of the bed of spheres is the extrapolated boundary of neutron diffusion for slab geometries of finite thickness. For infinitely thick slabs the value of the extrapolated boundary is identical with one derived by A. S. Eddington. A rigorous proof of Knudsen's well-known asymptotic formula for flow through a long circular capillary is also given. (auth)

5405 K-1302(Pt. IV)

Oak Ridge Gaseous Diffusion Plant, Tenn.

THE PROBLEM OF KNUDSEN FLOW. PART IV. SPECULAR REFLECTION. W. C. DeMarcus. Mar. 27, 1957. 22p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The solution of the Boltzmann equation when the impact of gas molecules with a solid surface does not lead to scattering or re-emission with Lambert's cosine law but rather to partial specular reflection is considered. It was found that the solution hinges upon the solution of a Clausing integral equation but that the general nature of the kernel and related functions are somewhat more complex than those arising in the case of purely diffuse reflection. Two systems, circular capillary and semi-infinite slit, were analyzed, and numerical evaluation was performed for Knudsen Flow through a circular capillary. The Smoluchowski formula was derived for "infinitely long" tubes and the limitations of its applicability are discussed. The limitations were found to be severe enough that Smoluchowski's correction should not be applied indiscriminately to practically all Knudsen Flow problems as is currently the practice. (auth)

5406 NP-6235

Mine Safety Appliances Co., Callery, Penna.

SOLUBILITY OF SEVERAL GASES IN ISOPROPYL BIPHENYL AT ATMOSPHERIC PRESSURES AND UP TO 125 C. Memo Report No. 122. R. Gagne and E. F. Batutis. Nov. 26, 1956. 8p. Contract NObs-65426.

The solubility of several gases has been determined in isopropyl biphenyl at 760 mm Hg and temperatures up to 125°C. The solubilities expressed in cc gas (at STP)/cc

of IPB at 25°C for N = 0.020; H = 0.023; O = 0.78; CO_2 = 0.91; methane = 0.23 and ethane = 1.41. Of the gases studied only CO_2 and ethane decreased in solubility as the temperature was increased. (auth)

5407

CALCULATION OF THE VISCOSITY OF GASEOUS He^3 AND He^4 AT LOW TEMPERATURES. William E. Keller (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 105, 41-5 (1957) Jan. 1.

The viscosity coefficients for gaseous He^3 and He^4 have been calculated to the second order approximation from 0 to 40°K according to the quantum-mechanical theory of transport phenomena. Results are presented for two intermolecular potentials, the Lennard-Jones 12-6 (LJ1) and the exp-6 (MR5) functions. Contrary to expectation, LJ1 provides a better over-all fit to experimental data. A brief survey is given of the theory, previous calculations, and existing experimental data, with the conclusion that the low-temperature transport properties of the gaseous helium isotopes are not yet described with certainty by either experiment or theory. (auth)

INSTRUMENTS

5408 AERE-GP/R-1694

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN INSTRUMENT FOR EXAMINING THE PROFILES OF FABRY-PEROT INTERFERENCE FRINGES. A. H. Turnbull. June 17, 1955. 11p.

A photoelectric method of examining the profiles of the fringes formed by a Fabry-Perot interferometer is described. (auth)

5409 NYO-7313

Princeton Univ., N. J. Project Matterhorn.

A RESISTANCE ANALOGUE DEVICE FOR STUDYING AXIALLY SYMMETRIC MAGNETIC FIELDS. Kenneth E. Wakefield. Dec. 13, 1956. 58p. (PM-S-23). $9.30(ph OTS); $3.60(mf OTS).

The general problem of determining the location of stream lines of a magnetic field defies easy, practical solution even for cases where only approximate results are required. The methods usually employed include measurements on models, flux plotting, lengthy hand calculations, or the use of punched card calculators or electronic computers; all of these methods are costly and time-consuming. A device is described which provides a quick and inexpensive means for obtaining solutions to these and associated magnetic field problems in which there is an axis of symmetry. A two-dimensional network of resistors is used to represent a plane through the axis of an axially symmetric magnetic or electromagnetic system; on this plane the surfaces of constant flux (stream lines) usually appear as closed loops. Currents, corresponding to coil ampere-turns, are fed into the network at positions corresponding to the coil locations and are collected on the boundary of the network corresponding to the axis of the system. Other operations, described later, which simulate magnetic material, are performed on the network at positions corresponding to the location of this material. The potentials appearing at the nodes form a net through which one can draw the equipotential lines. If the resistance network has been properly designed, the position of these equipotential lines will accurately represent the position of the stream lines of the electromagnetic system. From the location of these lines and the magnitude of the potentials, other quantities such as flux density, field intensity, and inductance can be found. It is readily seen that such a device, which is easily built and inexpensively operated, provides a general means for solving a host of problems involving magnetic fields having an axis of symmetry. (auth)

5410 RIB-16

Du Mont (Allen B.) Labs., Inc. Tube Research Labs., Passaic, N. J.

DEVELOPMENT OF DU MONT PHOTOMULTIPLIER TUBES. Report No. 21 [for] December 1, 1954 to May 31, 1956. Bernard R. Linden, Philip A. Snell, and Robert E. Rutherford. 24p. Contract AT(30-1)-1336. $0.35(OTS).

Photographs and specifications are given for ¾-in. ten-stage photomultiplier tubes and large area photomultiplier tubes. The development of a fast high gain linear photomultiplier tube is also discussed. Data are included on transit time spread in photomultiplier tubes. (For preceding period see RIB-15.) (B.J.H.)

5411 AEC-tr-2828

DIELECTRIC AMPLIFIERS. V. G. Nazarov. Translated by P. Collins from Radiotekhnika 10, 44-57(1955). 12p.

The principles of operation of dielectric amplifiers and their circuits are described. Essential data on materials for use in non-linear condensers are given. (D.E.B.)

5412

AN ULTRASONIC SCANNER AND RECORDING SYSTEM. W. N. Beck (Argonne National Lab., Lemont, Ill.). Non-Destructive Testing 15, 42-3, 46(1957) Jan.–Feb.

An ultrasonic scanner was designed and fabricated for the purpose of handling production volume at production schedules. (auth)

5413

PULSE-LENGTHENER CIRCUITS. M. A. Meyer (Univ. of Potchefstroom, South Africa). Nuclear Instr. 1, 62-5(1957) March.

Existing and new circuits are discussed which convert pulses of short duration proportionally into flat-topped pulses of which the duration varies from a few tenths of a microsecond to several seconds. (auth)

5414

A VERY FAST PULSE-HEIGHT ANALYSER WITH INDEPENDENT UPTAKE, SORTING AND STORAGE OF INFORMATION. R. V. Gasstrom (Univ. of Groningen). Nuclear Instr. 1, 75-9(1957) March.

A kicksorter is proposed with an uptake resolution of the order of 10^{-8} s and a mean counting rate without loss of 10^5 pps. The principle is suited for both continuous as well as intermittent sorting and is based on a storage-tube display of the uptake which is scanned for sorting. The read-off information is temporarily stored per channel before it is injected into a large capacity accumulating memory. (auth)

5415

A DEVICE FOR TENSILE TESTS OF IRADIATED METALS. R. E. Hueschen and D. C. Kaulitz (Hanford Atomic Products Operation, Richland Wash.). Nucleonics 15, No. 3, 88, 90-2(1957) March.

Design of a direct optical strain-measuring device for tensile test of irradiated metals is presented. (W.L.H.)

5416

PLANE-PARALLEL SPARK COUNTERS FOR THE MEASUREMENT OF SMALL TIMES. M. V. Babykin, A. G. Plakhov, Yu. F. Skachkov, and V. V. Shapkin. Soviet J. Atomic Energy 4, 487-94(1956).

Descriptions are given of the construction and the results of investigations of the characteristics of plane-parallel spark counters filled with argon and diethyl ether vapor. (auth)

5417
INVESTIGATION OF THE TIME-RESOLVING POWER OF PLANE-PARALLEL SPARK COUNTERS. E. K. Zavoisky and G. E. Smolkin. Soviet J. Atomic Energy 4, 495-9 (1956).

A study has been made of the resolving power of plane-parallel spark counters with small working gap and high pressure of the gas mixture. It is shown that the resolution time of such counters may reach 10^{-9} sec. (auth)

5418
APPLICATION OF THE PHOTOMULTIPLIER FEU-12 TO SCINTILLATION SPECTROSCOPY. Iu. A. Nemilov, V. M. Ovchinnikov, A. N. Pisarevsky, and E. D. Teterin. Soviet J. Atomic Energy 4, 501-6(1956).

An investigation was made of the spectral response and other characteristics of the FEU-12 photomultiplier having grid-type dyhodes and developed by G. S. Vildgrube. (auth)

ISOTOPES

5419
PHOSPHORUS ISOTOPES P^{32} AND P^{33} IN RAIN WATER. D. Lal, N. Narasappaya, and P. K. Zutshi (Tata Inst. of Fundamental Research, Bombay). Nuclear Phys, 3, 69-75(1957) March.

In 1955, Marquez and Costa detected phosphorus 32 (half life ≈ 14 days) in rain water. Its presence was attributed to the spallation of atmospheric argon nuclei by cosmic rays. The second short lived radioisotope of phosphorus, P^{33} (half life ≈ 25 days) has now been detected in rainwater. Approximate concentrations (atoms ml^{-1} of rain water) of the two isotopes have been obtained; both are present in comparable amounts. The observed concentrations agree in order of magnitude with those reported by Marquez and Costa for P^{32}. They agree also with a rough estimate based on the number of disintegrations produced in the atmosphere by cosmic radiation and the estimated cross section for this reaction. A simultaneous determination of the concentrations in rain water of these chemically identical radioactive nucleides, may prove valuable in meteorological studies. It may be useful for tracing the large scale motion of air masses. (auth)

5420
HANDBOOK OF RADIOISOTOPE APPLICATIONS. Jerome D. Luntz, ed. New York, Nucleonics. 144p. Price $1.00.

Topics discussed in this handbook include radiation sources; industrial applications; food sterilization; chemical uses of radioisotopes; uses of radioisotopes in biology, medicine, and agriculture; and applications of radioisotopes in studies in the fields of geology and metallurgy. (C.H.)

ISOTOPE SEPARATION

5421 NP-6214
ARC INITIATED DISCHARGE IN MAGNETIC FIELD IN HIGH VACUUM. I. IONIC CENTRIFUGE TYPE OF DISCHARGE. Joseph Slepian. June 1956. 15p.

An ionic centrifuge type of discharge was investigated as a possible method of isotope separation. This type of discharge from a central electrode ran to an insulated cylindrical electrode which floated approximately at the Larmor potential and took half the yield of cations from the arc. The remaining cations went to end plates having potentials exceeding the Larmor potential. The discharge shows no space charge limitations, however, its use in isotope separation did not appear promising since its enrichment at the end plates was less than m/2m. (D.E.B.)

5422 NP-6215
ARC INITIATED DISCHARGE IN MAGNETIC FIELD IN HIGH VACUUM. II. MAGNETO-IONIC EXPANDER TYPE OF DISCHARGE. Joseph Slepian. Aug. 1956. 18p.

The theory of the magneto-ionic isotope separator is discussed, and the equations describing the magnetic and electrostatic forces at various locations in the separator are developed. (D.E.B.)

5423 NP-6216
A NOVEL MAGNETO-IONIC MEANS FOR SEPARATING ISOTOPES IN VERY LARGE QUANTITIES. Joseph Slepian. Nov. 1956. 17p.

Isotopes of ions of the same kinetic energy are sent by a magnetic field on slightly different paths, permitting their separation as in the mass spectrometer. The current, however, is limited to a very low value by their space charge. Their space charge can be eliminated by the presence of electrons substantially at rest, as in the Calutron, but oscillations inherently set themselves up at a new value of limiting current which is again too low for practical separation. A new Magneto-Ionic Expander Isotope Separator which has no space charge limit is described. This method of isotope separation is believed to be more economical than any other known method. (auth)

5424
DETERMINATION OF THE SEPARATION COEFFICIENTS OF THE ISOTOPES OF BORON IN THE EQUILIBRIUM EVAPORATION OF BCl_3. N. N. Sevryugova, O. V. Uvarov, and N. M. Shavoronkov. Soviet J. Atomic Energy 4, 567-72 (1956).

The separation coefficients of the isotopes of boron are determined for equilibrium evaporation of boron chloride in the temperature interval 12.7 to 85°C. The methods are described, and the equation relating the dependence of the coefficient on the vaporization temperature is derived. (auth)

5425
ENRICHMENT OF U ISOTOPES IN A COUNTERCURRENT GAS CENTRIFUGE. W. Groth, E. Nann, and K. H. Welge. Z. Naturforsch. 12a, 81(1957) Jan. (In German)

MASS SPECTROGRAPHY

5426
A POSSIBLE APPLICATION OF CYCLOTRON RESONANCE TO MASS SPECTROMETRY. V. N. Lazukin (Moscow State Univ.). Soviet Phys. JETP 4, 266-7(1957) March.

The principle of operation of a possible mass spectrometer utilizing cyclotron resonance is described. The spectrometer would measure the cyclotron frequencies of ions of the various masses, and the masses could then be calculated by the formula $\nu = eH/2\pi mc$. A schematic diagram of such a spectrometer is included. (B.J.H.)

MATHEMATICS

5427 AECU-3259
RAND Corp., Santa Monica, Calif.
APPLICATIONS OF MONTE CARLO. Herman Kahn. Apr. 19. 1954. Revised Apr. 27, 1956. 257p. Contract AT(11-1)-135. (RM-1237-AEC). $1.25(OTS).

The general principles of making Monte Carlo calculations are outlined. Discussions are included on techniques with random variables, transformations of random variables, rejection techniques for producing independent sample values of a distribution F(x), and manipulations of distributions. The various methods which are described

are illustrated by numerous examples. Detailed analyses are also given of Monte Carlo methods of evaluating integrals and integral equations. (B.J.H.)

5428 K-1322
Oak Ridge Gaseous Diffusion Plant, Tenn.
A BASIC MANUAL OF ROUTINES FOR THE 650. E. M. Kidd, ed. Mar. 28, 1957. 133p. Contract W-7405-eng-26. $0.70(OTS).

A description is given of the routines for the 650 Magnetic Drum Calculator contained in the subroutine library of the Numerical Analysis Department. (auth)

5429 NYO-7695
New York Univ., New York. Atomic Energy Commission Computing Facility.
NON-LINEAR DEFLECTIONS OF SHALLOW SPHERICAL SHELLS. Edward L. Reiss, Herbert J. Greenberg, and Herbert B. Keller. Dec. 31, 1956. 58p. Contract AT (30-1)-1480. $9.30(ph OTS); $3.60(mf OTS).

The equations obtained by Chien for the non-linear deflection of shallow spherical shells under uniform external pressure are solved by means of power series expansions following procedures introduced by Friedrichs and Stoker in their treatment of buckling of circular plates. These equations depend upon two parameters. One of these is related to the external pressure, while the other depends upon the dimensions of the shell. The equations are solved for several ranges of the parameters under boundary conditions corresponding to a fixed edge. The solution, carried out numerically on the Univac at New York University, yields a complete description of the stresses and deflections as functions of the polar angle over a wide range of values of the loading parameter and the dimensional parameter. Prediction of the upper buckling load is then made by means of a numerical criterion based on the load vs deflection curve. For some cases, the post-buckling behavior is investigated. The results agree well with existing experimental and theoretical studies and cover a wide range of cases not previously treated. (auth)

5430 NYO-7696
New York Univ., New York. Atomic Energy Commission Computing Facility.
A NUMERICAL METHOD FOR THE TIME-DEPENDENT TRANSPORT EQUATION. R. D. Richtmyer. Feb. 1957. 40p. Contract AT(30-1)-1480. $6.30(ph OTS); $3.00(mf OTS).

A finite difference method has been devised for the numerical solution of the integro-differential equation of neutron transport in a sphere. The method is applied here to one-group problems with isotropic scattering, although some degree of generalization is possible. Special features of the method include integration of the equations along the neutron trajectories in space-time and special treatment of exceptional net points which lie near the boundary of the relevant region of phase space. The method is the outcome of a series of investigations initiated by a suggestion of Von Neumann in 1948. Numerical tests of the method, made with the Univac at New York University, are described. They deal with the problem of a homogeneous bare sphere subject to a singular initial condition. In connection with those tests, codes were devised to provide accurate numerical integration of the integral equation for the normal mode functions. (auth)

5431 UCRL-4714
California. Univ., Livermore. Radiation Lab.
SPLIT-WORD FLOATING-DECIMAL ROUTINE. Karl O. Malmquist, Jr. June 1956. 26p. Contract W-7405-eng-48. $0.25(OTS).

A pseudo code is presented which will reduce to a minimum the required coding space of a data-processing machine-type-650 problem, using floating-decimal arithmetic. It has been estimated that 25 to 35% space is saved over that of the IBM floating-decimal code. The basic idea of this routine is to split the machine-650 work in two, each half to perform one arithmetic operation on specified data. The time expended for computing the basic arithmetic operations is comparable to those arithmetic operations used in Technical News Letter Eight of the IBM floating-decimal routine. (auth)

5432 WAPD-TM-40
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A COMPLETE INTERPRETIVE DOUBLE PRECISION RATIONAL NUMBER SYSTEM FOR THE IBM TYPE 650. Richard B. Smith. Aug. 1956. 20p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

5433
COMPUTERS, MATHEMATICS, STATISTICS, AND AUTOMATION. Arthur Rose (Applied Science Lab., Inc., State College, Pa.), R. Curtis Johnson (Washington Univ., St. Louis, Mo.), Richard L. Heiny (Dow Chemical Co., Midland, Mich.), Theodore J. Williams (Monsanto Chemical Co., Ohio), and Joan A. Schilk (Shell Development Co., Emeryville, Calif.). Ind. Eng. Chem. 49, 554-64(1957) March.

A literature review is presented which is divided into sections on: Theoretical Articles of Interest for Process Control; Use of Analogs to Simulate Process Dynamics and Control; Considerations in the Application of Process Control Components; Complete Instrumentation and Control Systems as Now Used; Applications of Digital Computers; Applications of Analog Computers; Instructional and Nontechnical Articles of General Interest. 147 references. (T.R.H.)

5434
SYMPOSIUM ON MONTE CARLO METHODS, HELD AT UNIV. OF FLORIDA, MARCH 16 AND 17, 1954. Herbert A. Meyer, ed. New York, John Wiley & Sons, Inc. 1956. 396p.

Texts are given of papers on the Monte Carlo technique and on the application of Monte Carlo methods to various problems. (B.J.H.)

5435
SOLID ANGLE COUNTOUR INTEGRALS, SERIES AND TABLES. A. Victor Masket (Univ. of North Carolina, Chapel Hill). Rev. Sci. Instr. 28, 191-7(1957) March.

The solid angle subtended at a point by any object is determined by the closed contour which outlines the "visible" boundary of the object from the point. By transformation of the double integral $\Omega = \iint \sin\theta d\theta d\varphi$ into a single integral over θ or φ with limits determined by the contour and choice of axes, the solid angle may be simply represented in the important cases discussed as a contour integral. The integration has been carried out on the high-speed digital computer ORACLE at Oak Ridge National Laboratory. Solid angle tables have been prepared for the case of the circular disk and the entire finite right circular cylinder in terms of cylindrical coordinates. Each table contains in excess of 12 000 entries to six significant figures. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

5436 AECU-3421
Nebraska. Univ., Lincoln.
SCINTILLATION RESPONSE OF CRYSTALS. [Period covered] February 1956 to August 1956. E. J. Zimmerman. 10p. Contract AT(11-1)-35. $1.80(ph OTS); $1.80(mf OTS).

Data are presented on the scintillation response of anthracene crystals to Po α particles, Cs^{137} β particles, and proton and helium ion beams from the accelerator in the range 50 to 375 kev. Results are presented graphically and are compared with previous data. (C.H.)

5437 AERE-EL/R-1972

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A SCINTILLATION COUNTER FOR AIRBORNE RADIOMETRIC SURVEYING. J. Pickup and M. E. Cosgrove. July 19, 1956. 26p.

A scintillation counter, designed for low flying radiometric surveys, attains a high degree of sensitivity by the use of a large sodium iodide crystal. Compact size, low weight, and power consumption are essential features which are achieved by employing transistor circuits. The equipment has been tested on a small scale survey and the results are discussed. (auth)

5438 AERE-N/M-60

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A THERMAL NEUTRON ANALYSER. P. A. Egelstaff. July 17, 1953. 5p.

A brief discussion is given on the design of an instrument which will measure the energy spectrum of neutrons from a monokinetic incident beam which are scattered at a given angle by a sample. (B.J.H.)

5439 AERE-N/M-71

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PULSE AMPLITUDE STORAGE AND ITS APPLICATION TO NUCLEAR PHYSICS. P. E. Cavanagh, C. F. Coleman, and J. F. Turner. Nov. 18, 1954. 4p.

It is suggested that pulse amplitudes could be recorded in permanent form on, for instance, a magnetic tape recorder which could then be played back into a standard pulse analyzer at high speed. The technical feasibility and possible applications of such a system are briefly discussed. (B.J.H.)

5440 HW-47576

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

STANDARDIZATION OF CALIBRATION WELLS. E. E. Donaldson. Jan. 6, 1957. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A 500 mg radium source was installed in the completed calibration well and it was then experimentally calibrated by means of ionization chambers. The radiation from the well was compared with the radiation from a standard source in a low-scatter situation. Use of the well brought about a change in the geometry of calibration which was found to result in a small change in the calibration of the high range of the CP chambers. (auth)

5441

THE DETERMINATION OF THE DISTRIBUTION OF INTERNALLY DEPOSITED THORIUM BY MEANS OF STUDIES WITH A REALISTIC PHANTOM. J. Rundo (Finsen Inst., Copenhagen). Acta Radiol. 47, 65-78(1957) Jan.

5442

RADIOCARBON DATING. W. B. Loosemore (U.K.A.E.A., Atomic Energy Research Establishment, Harwell). Atomics 8, 97-9(1957) March.

Various methods and instruments in radio-carbon dating are reviewed. (W.L.H.)

5443

MEASUREMENT OF THE SPECTRAL DISTRIBUTION OF SCATTERED 400 kVp X RAYS IN A WATER PHANTOM. D. V. Cormack, T. J. Griffith, and H. E. Johns (Univ. of Saskatchewan and Saskatchewan Cancer Commission, Saskatoon, Can.). Brit. J. Radiol. 30, 129-35(1957) March.

5444

X-RAY SPECTRUM FROM A BERYLLIUM WINDOW TUBE. II. LAPLACE TRANSFORMATION. P. K. S. Wang, R. J. Raridon, and R. C. Crawford (Vanderbilt Univ., Nashville, Tenn.). Brit. J. Radiol. 30, 153-7(1957) March.

5445

ON THE PREPARATION OF SILVER CHLORIDE NUCLEAR PHOTOGRAPHIC EMULSIONS. Henri Gauvin and Wilfrid Sebaoun. Compt. rend. 244, 1489-92(1957) March 11. (In French)

5446

ON THE PROPORTIONAL RESPONSE OF LARGE AREA LIQUID SCINTILLATION COUNTER FOR COSMIC RAYS. G. H. Vaze (Tata Inst. of Fundamental Research, Bombay). J. Sci. Ind. Research (India) 16B, 1-4(1957) Jan.

A large area liquid scintillation counter viewed by two photomultipliers, showing uniform sensitivity and negligible dark current noise background, is described. Its response for cosmic ray events was investigated by a synchroscopic method. Cosmic ray events were selected by a suitable G. M. counter assembly forming a coincidence arrangement. Master coincidence pulse from the G. M. counter assembly was used to trigger the synchroscopic circuit, and the time associated output from the liquid scintillation counter displayed on Y axis was recorded by a camera. The pulse height distribution data obtained by the above method are presented. (auth)

5447

ELECTRONIC TIME ANALYZER APPLIED TO THE MEASUREMENT OF THE HALF-LIVES OF METASTABLE NUCLEAR STATES. Per-Arne Tove (Gustaf Werner Inst. for Nuclear Chemistry, Uppsala). Nuclear Instr. 1, 95-100 (1957) March.

An electronic 20 channel time analyzer has been applied to the measurement of the half-lives of metastable nuclear states in the 100 μsec region. The electronic circuits are described and measurements principles discussed, with special regard to the possibility of measuring longer-lived states. (auth)

5448

PRECISION QUANTAMETER FOR HIGH ENERGY X-RAYS. Robert R. Wilson (Cornell Univ., Ithaca, N. Y.). Nuclear Instr. 1, 101-6(1957) March.

An ionization chamber has been designed to serve as a standard for measurements of the intensity of beams of high energy photons. The chamber consists of twelve 1 cm plates of Cu. The ionization in the shower is sampled at the twelve gaps between plates, and the gap widths are arranged so that a Simpson's rule integration of the shower curve is automatically made. By making the last gap larger and by making an appropriate gap at the sides of the chamber, a compensation is made for any leakage of energy out of the chamber. The total energy content of a photon beam, U, should be accurately proportional to the ionization charge measured, q, independently of the spectral shape of the beam. An absolute calibration of the chamber has been calculated to an accuracy of a few percent. A density effect correction to the stopping power of Cu has been included in the calculation. (auth)

5449

MULTI COINCIDENCE GONIOMETER FOR ANGULAR CORRELATION MEASUREMENTS. Tor Ragnar Gerholm and Torsten Lindqvist (Univ. of Uppsala, Sweden) and Hendrik

de Waard (Univ. of Groningen, Netherlands). Nuclear Instr. 1, 107-11(1957) March.

Four scintillation detectors view the same source. All six coincidence combinations between these are recorded simultaneously. A "coincidence cross delay" speeds up the measurement of angular correlations by another factor of two. It is shown that the instrument is self-monitoring and that the coincidence counting effiency is an order of magnitude higher than in a conventional arrangement with two detectors. It is concluded that the instrument is suitable for the study of very short lived isotopes. The apparatus was checked with the Co^{60} 1.17–1.33 Mev cascade and the Bi^{207} 1.06–0.57 Mev cascade. (auth)

5450

FURTHER ANALYSIS OF THE NEUTRON COMPONENT OF THE BACKGROUND OF COUNTERS USED FOR ^{14}C AGE MEASUREMENTS. Hl. De Vries (Univ. of Groningen). Nuclear Phys. 3, 65-8(1957) March.

The background of counters, used for C^{14} age measurements, has been reduced appreciably by a special arrangement of blocks of paraffin wax (mixed with boric acid) inside the iron shield. The background could be divided into a constant fraction, probably due to radioactive contamination of the counter, and a fraction, depending on the barometric pressure, due to locally produced neutrons. The neutron background has been reduced by a factor of about 7; the barometer effect was 10 per cent of the neutron component per cm Hg in all arrangements studied. The relative increase of the neutron component in the C^{14} counter during the solar flare of February 23 has been the same as in the neutron monitor. (auth)

5451

X-RAY ESCAPE GATING AS APPLIED TO A PROPORTIONAL COUNTER. C. W. McCutchen (Cavendish Lab., Cambridge). Nuclear Phys. 3, 76-82(1957) March.

A method of low-energy γ spectroscopy is described which employs a xenon-filled proportional counter and a NaI scintillation counter. The xenon counter is placed in the gamma flux while the scintillator counts the xenon fluorescence x rays which follow photoelectric absorption of γ rays in the proportional counter. A pulse from the proportional counter is passed to the kicksorter only when the scintillator receives a xenon K x ray. The recorded spectrum thus contains only K x-ray escape peaks and is easy to interpret. The method is described in detail and a practical example is given. A possible extension of the method to conversion-electron spectroscopy is proposed. (auth)

5452

MEASURING FLUX ABSOLUTELY WITH INDIUM FOILS. Moses A. Greenfield, Roscoe L. Koontz, Alan A. Jarrett, and Juanita K. Taylor (North American Aviation, Inc., Canoga Park, Calif.). Nucleonics 15, No. 3, 57-61(1957) March.

A method is presented for measuring neutron flux by the absolute disintegration rate of an activated In foil, with a known thermal-neutron-absorption cross section of In^{115}. A 2π proportional flow counter is used for the measurements. (W.L.H.)

5453

DELAY-LINE CHAMBER HAS LARGE AREA, LOW CAPACITANCE. Wilmot N. Hess, H. Wade Patterson, and Roger Wallace (Univ. of California, Berkeley). Nucleonics 15, No. 3, 74, 76-9(1957) March.

5454

ALPHA-SCINTILLATION MONITOR FOR HANDS AND CLOTHING. J. Nicholls (Burndept Ltd., Erith, Kent, Eng.). Nucleonics 15, No. 3, 80-1, 83-4(1957) March.

5455

AUTORADIOGRAPHIC DETERMINATION OF RADIOACTIVITY IN ROCKS. Albert P. Abrahams (New York State Dept. of Labor New York). Nucleonics 15, No. 3, 85-6(1957) March.

An autoradiographic method is presented where 110 samples can be simultaneously exposed to the same sheet of film. (W.L.H.)

5456

LOW TEMPERATURE α COUNTING; A METHOD FOR AVOIDING RADON DIFFUSION. E. Picciotto and F. Salvetti. Nuovo cimento (10) 3, 815-19(1956) April. (In French)

5457

LEVEL FLIGHTS WITH EXPANSIBLE BALLOONS. J. E. Laby, Y. K. Lim, and V. D. Hopper (Univ. of Melbourne). Nuovo cimento (10) 5, 249-59(1957) Jan.

Single rubber or neoprene balloons have been used to obtain level flights at altitudes in the region 80,000 to 150,000 feet to expose nuclear emulsion plates to cosmic radiation. String operated valves have been developed and a comparison is made of the performance of various sizes of rubber and neoprene balloons. On some flights a clock released a load after the balloon had levelled off and for these the new ceiling height has been investigated. (auth)

5458

CHECKING OF THE DIFFUSION OF RADIOELEMENTS IN NUCLEAR EMULSIONS BY EXPOSURE TO LOW TEMPERATURE. M. Debeauvais, E. Picciotto, and S. Wilgain. Nuovo cimento (10) 5, 260-5(1957) Jan. (In French)

It is shown that the diffusion of radioelements in nuclear emulsion can be checked by the action of low temperature. The effect of diffusion is no longer observed at −85°C for radon and at −36°C for Tn. At these respective temperatures, the observed division between stars and simple tracks corresponds to the theoretical division. This method permits the use of the characteristic phenomenon of the formation of stars as a measurement of weak quantities of radioelements. (tr-auth)

5459

METHOD OF THE FAST COMMAND OF TRACK COUNTERS. S. Focardi, C. Rubbia, G. Torelli, and F. Bella. Nuovo cimento (10) 5, 275-82(1957) Jan. (In Italian)

The present paper is divided in two parts. The first part studies the working of plane counters. In the second one some new fast coincidence circuits are presented. The paper in the whole is a contribution to the problem of the very fast production of high voltage impulsions at the passage of an ionizing particle through a suitable detector. This problem is of practical interest given the expedience which sometimes arises (for instance in nuclear physics experiments) to be able to submit a given space to a strong electric field immediately after it has been traversed by an ionizing particle. This can be exemplified by a monitored hodoscope or bubble chamber. (auth)

5460

NUCLEAR-REACTOR-CONTROL IONIZATION CHAMBERS. W. Abson and F. Wade. Proc. Inst. Elec. Engrs. (London) 103, Part B, No. 11, 590-6(1956) Sept.

The design and the electrical characteristics of a neutron-sensitive d.c. ionization chamber suitable for a wide range of applications in nuclear-reactor-control instrumentation systems are described. Thermal-neutron sensitivities of 10^{-13} to 10^{-14} amp/n/cm^2/sec can be obtained using BF_3 filling or B-coated electrodes with H filling. The corresponding γ-radiation sensitivities are of the order of 10^{-12} to 10^{-11} amp/r/h. Virtually complete collection of the ionization current is possible, up to neutron flux levels of

10^{11} n/cm^2/sec, with a polarizing voltage of a few hundred volts. The residual current due to neutron-induced activities in the chamber falls to less than 10^{-6} times the full-power neutron current some 20 min after shut-down. The sitting of ionization chambers has an important bearing on their range of utilization in control-instrumentation systems, and this is discussed briefly in relation to the electrical characteristics of the chambers described. (auth)

5461

PHYSICAL MEASUREMENTS ON A 4-MEV LINEAR ACCELERATOR. C. A. Murison and H. A. Hughes (Western General Hospital, Edinburgh, Scotland). Radiology 68, 367-79(1957) March.

5462

TOTAL ABSORPTION ČERENKOV COUNTER. W. B. Jones, H. R. Kratz, and J. Rouvina (General Electric Research Lab., Schenectady, N. Y.). Rev. Sci. Instr. 28, 167-75(1957) March.

A Čerenkov counter is described for detecting and measuring the energy of x-rays in the 50-to 300 Mev range. The incident x-ray produces a photon-electron shower in a cylinder of CCl_4, and the Čerenkov radiation emitted by the electrons in the shower is a measure of the x-ray energy. The cylinder of CCl_4 is 12 in. diam by 36 in. long. The Čerenkov radiation is measured with seven 5-in. photomultiplier tubes mounted at one end of the cylinder. The pulse distribution from the counter has a $\sigma/\bar{x}$ which varies from 0.146 at 217 Mev to 0.216 at 47 Mev. The energy response of the counter is linear up to 217 Mev, the highest energy at which measurements have been made. (auth)

5463

FAST MULTI-EVENT SCALER. R. Woldseth (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Rev. Sci. Instr. 28, 208(1957) March.

5464

PHOTOSCANNING DETECTION OF RADIOACTIVE TRACERS IN VIVO. M. A. Bender (Roswell Park Memorial Inst., Buffalo, N. Y.). Science 125, 443-4(1957) Mar. 8.

MESONS

5465

ON THE SPIN AND PARITY OF THE τ-MESON. I. S. Shapiro and E. I. Dolinsky (Moscow State Univ.) and A. P. Mishakova (USSR Academy of Sciences, Moscow). Nuclear Phys. 3, 60-4(1957) March.

Energy distribution curves of π^--mesons produced in τ^+-decays have been obtained by assuming that the isobaric spin of the three π-meson system equals unity and the ratio of probabilities of τ and τ' decays is 4. Comparison of the theoretical results with experimental data referring to 492 τ^+-decay events shows that the most probable values for τ-meson spin and parity is the 0^- combination. (auth)

5466

ON THE UNIVERSAL INTERACTIONS. II. K-MESON DECAYS INTO PIONS. S. Oneda (Univ. of Manchester). Nuclear Phys. 3, 97-114(1957) March.

The idea of the previous work which aims at explaining the complicated interactions between elementary particles in terms of universal interactions in further explored, concentrating on the weak interactions between baryon-meson systems. Present experimental situations are analyzed qualitatively by the simple phase-space arguments which suggest that it is more sensible to compare the life-times of Λ^0, θ^0 and τ^+-decays than to compare those of θ^0 and θ^+-decay. Taking $\Lambda^0 \rightarrow \mathcal{N} + \pi$ interaction as the main source of the weak baryon-meson interactions, the required property of this interaction in isobaric spin space is investigated. As an orientation regarding the order of magnitude, the evaluations of the transition probabilities of θ-decays and τ-decays in our model are made. The interactions which are responsible for the occurrence of the $\theta^+ \rightarrow \pi^+ + \pi^0$ are investigated. The connections with the compound particle models are briefly discussed. (auth)

5467

A POSSIBLE EXPLANATION OF THE ANOMALOUS SCATTERING OF μ-MESONS. G. N. Fowler (Univ. of Manchester). Nuclear Phys. 3, 121-6(1957) March.

The elastic Coulomb scattering cross section of μ mesons at large angles is affected by inelastic scattering of the incident μ mesons when the energy transfer is ≥ 150 Mev. This effect is found to give results which are not inconsistent with the observations on the large angle scattering μ mesons by lead nuclei if $\sigma_{inel} \approx 4$ mb/nucleus. (auth)

5468

INTERACTIONS OF NEGATIVE K-PARTICLES AT REST. W. W. Chupp, G. Goldhaber, S. Goldhaber, and F. H. Webb (Univ. of California, Berkeley). Nuovo cimento (10) 4, Suppl. 2, 382-9(1956).

Stacks of Ilford G5 emulsions were exposed to the focused K^- beam at the Bevatron. Data concerning all observed stopping events are compiled. Predictions of the masses of K^+, Σ^+, and Σ^- particles are included. (B.J.H.)

5469

NUCLEAR SCATTERING OF K^+-MESONS IN THE ENERGY REGION OF 80 MeV. N. N. Biswas, L. Ceccarelli-Fabbrichesi, M. Ceccarelli, K. Gottstein, N. C. Varshneya, and P. Woloschek. Nuovo cimento (10) 5, 123-41(1957) Jan.

The scattering of K^+ mesons by nuclei of photoemulsion has been investigated in the 60 to 100 Mev region. Data on 27 collisions of K^+ mesons with hydrogen nuclei, collected from various laboratories, are also presented. The angular distribution of the elastic scatterings is compared with curves calculated by Costa and Patergnani for an optical model of the nucleus. The inelastic scattering data are, instead, compared with the results of a calculation performed with the Monte Carlo method, for a Fermi-gas nuclear model. Experimental evidences, such as the frequent occurrence of small angle elastic scatterings and the rarity of large energy losses, argue in favor of a repulsive nuclear potential acting on the K^+ meson. The angular distribution of the K^+-p collisions is then satisfactorily described assuming a predominant s-wave scattering for energies lower than ~50 Mev in the center of mass system. The data on the K^+-nuclei inelastic scattering are shown instead to be well described, on the basis of the Fermi model, with the assumption that the K-nucleon cross section is peaked backwards or is energy dependent. The influence of the two isotopic spin states which intervene in the K-nucleon scattering is discussed. (auth)

5470

K^+-MESON INTERACTION WITH NUCLEONS AND NUCLEI. G. Cocconi, G. Puppi, G. Quareni, and A. Stanghellini. Nuovo cimento (10) 5, 172-82(1957) Jan.

The results obtained in several laboratories on the nuclear interaction of the K^+ mesons of energy between 40 and 150 Mev have been analyzed. It is assumed that all K^+ mesons have identical interaction properties and that Gell-Mann's scheme is correct. The main results are the following: 1) The total cross-section for the process $K^+ + p$ (isotopic spin state T = 1) is $\sigma_p = 14 \pm 3$ mb. The corresponding differential cross section may be described essentially with S-wave and coulombian constructive interference. 2) The isotopic spin state T = 0 is not negligible

compared to T = 1. P wave should be important in the T = 0 state. 3) To explain the K^+ meson interaction with nuclei, a nuclear repulsive potential V ≃ 10 Mev should be added to the coulombian potential. With these assumptions descriptions can be given: the elastic scattering in terms of the optical model; and the inelastic scattering, by considering the interaction due to single collisions of the K^+ mesons with the nucleons (which are considered as independent particles of a Fermi-gas). The K^+ nucleon interaction in the T = 1 state may be described by a central potential equivalent to a hard-core of radius a = 0.8($\hbar$/m_Kc). (auth)

5471

DEMONSTRATION OF THE EXISTENCE OF THE Σ^0 HYPERON AND A MEASUREMENT OF ITS MASS. R. Plano and N. Samios (Columbia Univ., New York) and M. Schwartz and J. Steinberger (Brookhaven National Lab., Upton, N. Y.) Nuovo cimento (10) 5, 216-19(1957) Jan.

Three events, demonstrating the existence of the Σ^0 hyperon, have been found in a propane bubble chamber. The Q value for the decay $\Sigma^0 \rightarrow \Lambda^0 + \gamma + Q$ has been measured to be (73.0 ± 3.5) Mev. (auth)

5472

AN ANALYSIS OF ROCHESTER $K_{\mu 3}$ AND K_{e3} DATA. S. Furuichi, Y. Sugahara, and M. Yonezawa (Hiroshima Univ.) and A. Awaksa (Kanazawa Univ.). Nuovo cimento (10) 5, 285-8(1957) Jan.

A mathematical analysis was made of experimental data obtained on $K_{\mu 3}$ and K_{e3} mesons. It was found that the spin 1 possibility cannot be rejected for $K_{\mu 3}$; that K_{e3} seems to have spin O and Fermi interaction of the Fermi type participates mainly in the decay; and, that high spin possibility is very small for K_{e3}. (B.J.H.)

5473

MEAN FREE PATH OF 4.3 GeV π^--MESONS IN NUCLEAR EMULSIONS. A. Marques, N. Margem, and G. A. B. Barnier. Nuovo cimento (10) 5, 291-2(1957) Jan.

The mean free path for nuclear interactions of 4.3-Bev π^- mesons in Ilford G5 emulsions was found to be 33.7 ± 4.7 cm. (B.J.H.)

5474

THE PRODUCTION OF π-MESONS IN PROTON-PROTON COLLISIONS AT 925 MeV. I. S. Hughes, P. V. March, and H. Muirhead (Univ. of Glasgow) and W. O. Lock (Univ. of Birmingham, Eng.). Phil. Mag. (8) 2, 215-30(1957) Feb.

A study has been made of the production of π mesons in the collisions of protons having an energy of 925 Mev, with the hydrogen present in nuclear emulsions. The results yield the following cross sections: $p + p \rightarrow \pi^+ + n + p$, 27 ± 3 mb; $\pi^+ + D$, 0.6 ± 0.4 mb; $\pi^0 + p + p$, 6 ± 2 mb; and $\pi^+ + \pi^- + p + p$, ≤ 0.2 mb. Angular and momentum distributions have been obtained for particles emitted in the first process. The results may be interpreted in terms of the production of mesons by the decay of an excited nucleon. (auth)

5475

STATIC MODEL FOR PRODUCTION OF STRANGE PARTICLES. D. C. Peaslee (Univ. of California, Berkeley). Phys. Rev. 105, 1034-6(1957) Feb. 1.

A phenomenological model is considered where a nucleon is supposed to be "predissociated" into a virtual (Λ + K) or (Σ + K) combination. These components are realized in a "stripping" type collision with an incident pion. Reasonable parameters for the model are obtained from fitting to π^- + p measurements; the value of a corresponding π^+ + p measurement in this connection is pointed out. The "radius" of the (Λ + K) system turns out to be of order 5 × 10^{-14} cm. The same model can be applied to K production in 6-Bev proton-nucleon bombardment; it yields one component of K's with an extremely strong forward-backward peaking in the center-of-momentum system of the two nucleons. (auth)

5476

MESON PRODUCTION IN n-p COLLISIONS AT COSMOTRON ENERGIES. W. A. Wallenmeyer (Brookhaven National Lab., Upton, N. Y. and Purdue Univ., West Lafayette, Ind.). Phys. Rev. 105, 1058-67(1957) Feb. 1.

Neutrons produced by 1.5-Bev p-C collisions within the vacuum tank of the Cosmotron, when incident upon the protons in the Brookhaven twenty-atmosphere, hydrogen-filled, magnet diffusion chamber, produced a number of three-prong events. Of these events, 182 were of analyzable quality and have been classified as being a result of the reactions $n + p \rightarrow p + p + \pi^-$, $\rightarrow p + p + \pi^- + \pi^0$, and $\rightarrow p + n + \pi^+ + \pi^-$ in the ratio of (53 ± 11) : (8 ± 4) : (39 ± 9), respectively, where the errors given are twice the statistical errors to allow for classification uncertainties. The observed ratio of double to single meson production, though considerably lower than that which was found with the higher energy (2.2 Bev max) neutrons of the previous n-p experiment by Fowler, Shutt, Thorndike, and Whittemore, is still more than twenty times as great as the ratio predicted by Fermi's statistical theory of meson production. However, the observed ratio is in good agreement with the predicted ratio of 47 : 14 : 39 obtained from the statistical model as refined by Kovacs, where consideration is given to the resonance enhancement of double meson production and to the suppression, by angular momentum and parity conservations, of the (pp−) reaction. The data show that the proton and the π^+ and also the neutron and the π^- tend to be emitted in opposite directions to each other much more frequently than do the proton and the π^- or the neutron and the π^+. This may be an argument in favor of an intermediate, exicted state (T = 3/2, J = 3/2) model. There is no apparent evidence of any specific excitation energy for such a model from the data. (auth)

5477

PHOTOPRODUCTION OF CHARGED MESONS FROM DEUTERONS. S. Penner (Univ. of Illinois, Champaign). Phys. Rev. 105, 1113-16(1957) Feb. 1.

The photoproduction cross sections of charged mesons from deuterons are calculated in the impulse approximation. Expressions for the angular distribution and total cross section are obtained in terms of free-nucleon cross sections and the nuclear potential. The results are in good agreement with the experimental measurements of π^+ production near threshold. (auth)

5478

REGENERATION OF θ_1^0 MESONS BY A MAGNETIC FIELD. Myron L. Good (Univ. of California, Berkeley). Phys. Rev. 105, 1120(1957) Feb. 1.

It is pointed out that regeneration of θ mesons by a magnetic field should occur if the θ^0 has a spin and magnetic moment. (B.J.H.)

5479

MASS VALUE FOR THE Σ^- HYPERON. Stanley C. Freden and Harold K. Ticho (Univ. of California, Los Angeles). Phys. Rev. 105, 1121(1957) Feb. 1.

An event was observed which can be attributed to the reaction $K^- + p \rightarrow \Sigma^- + \pi^+$. An analysis of the tracks gave a value of 2340.7 ± 1.3 m_e for the Σ^- mass. (B.J.H.)

5480

INTERACTION OF π-MESONS WITH π-MESONS. Ziro Koba (Kyoto Univ.). Progr. Theoret. Phys. (Japan) 15, 294-5 (1956) March.

It is shown that the π-π cross section inferred from Cos-

motron data is not inconsistent with that derived from cosmic ray experiments using the Landau theory of multiple production. (B.J.H.)

5481

ON K-MESON DECAYS AND THE UNIVERSAL INTERACTIONS. Sadao Oneda, Shoichi Hori, and Akira Wakasa (Kanazawa Univ.). Progr. Theoret. Phys. (Japan) 15, 304-6(1956) March.

5482

REMARKS ON THE PION-PION INTERACTION. Ziro Koba (Kyoto Univ.). Progr. Theoret. Phys. (Japan) 15, 461-72(1956) May.

The Cosmotron data on pion-nucleon reactions suggest the presence of a fairly strong pion-pion interaction near 1 Bev. The cosmic ray experiment performed recently by the Bristol group, when analyzed according to the Landau theory of multiple production, also leads to a similar conclusion. (auth)

5483

THE DECAY INTERACTION OF $K_{\mu 3}$ AND K_{e3} AND FERMI INTERACTION. Susumu Furuichi, Tatsuro Kodama, Yoshiko Sugahara, and Minoru Yonezawa (Hiroshima Univ.) and Adira Wakasa (Kanazawa Univ.). Progr. Theoret. Phys. (Japan) 16, 64-6(1956) July.

It is shown that it is possible to obtain some information on the types of Fermi interactions participating in the $K_{\mu 3}$ and K_{e3} decay processes from a study of the energy spectrum of the secondary muon and electron. (B.J.H.)

5484

INTERACTION OF K^+-MESON AND NUCLEON. Shigeo Minami (Osaka City Univ.). Progr. Theoret. Phys. (Japan) 16, 66-8(1956) July.

The interactions of K^+ mesons with nucleons are discussed. The relation between the ratio of charge exchange to non-charge exchange cross sections and the relative parities of hyperons and heavy mesons is discussed. (B.J.H.)

5485

NEW TYPE OF DISINTEGRATION OF A HEAVY MESON. O. A. Shakhulov, N. A. Kebuladze, E. A. Andronikashvili, and K. A. Abashidze (Academy of Sciences, Georgian SSR). Soviet Phys. JETP 4, 281-2(1957) March.

In the scanning of an emulsion stack which had been exposed in the stratosphere, three events were found of the decay of an unknown particle. The common characteristic of the events was the occurrence of a π-meson track of length $357\mu \pm 2\%$. The events are described in detail, and the possible interpretations of the tracks are discussed. (B.J.H.)

5486

ON THE PROBABILITIES OF Σ-PARTICLE DECAY. L. B. Okun. Soviet Phys. JETP 4, 284-6(1957) March.

Arguments developed by Fermi for the photoproduction of π mesons are applied to a consideration of the decay of the Σ hyperon. (B.J.H.)

5487

CORRELATIVE PHENOMENA IN K-MESON CAPTURE. V. B. Berestetskii and I. Ia. Pomeranchuk. Soviet Phys. JETP 4, 289-90(1957) March.

Refer also to abstract 5494.

NEUTRONS

5488 AERE-Inf/Bib-49(Rev.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A BIBLIOGRAPHY ON FAST NEUTRON REACTIONS, NUCLEAR STATUS, NEUTRON SPECTRA, AND SYSTEMATICS OF NUCLEI. Apr. 5, 1950. Decl. Nov. 20, 1956. 28p.

5489 AERE-NP/R-1577

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England

REPORT ON A CONFERENCE ON NEUTRON SOURCE PREPARATION AND CALIBRATION HELD AT BUCKLAND HOUSE ON THE 8TH AND 9TH OF JULY 1954. D. J. Littler. Dec. 1954. 63p.

5490 WADC-TR-57-89

Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.

THE TRANSMISSION OF FISSION NEUTRONS HAVING ENERGY ABOVE THE $S^{32}(n,p)P^{32}$ THRESHOLD BY STRAIGHT CYLINDRICAL DUCTS IN WATER. R. E. Benenson and A. N. Fasano. Feb. 1957. 37p. (AD-118088).

A ray analysis, employing an experimentally derived point attenuation function in water, has been carried out for straight cylindrical air ducts with diameters ranging from two inches to eighteen inches. An extended fission source and $S^{32}(n,p)P^{32}$ threshold detectors have been used throughout the corresponding experimental determinations. The results of the experimental determination of the transmission and the ray analysis agree to within 15% and indicate a significant contribution to the transmission from portions of the source not "seen" directly by the duct. (auth)

5491

POLARIZATION OF NEUTRONS SCATTERED BY LEAD. A. I. Baz. Soviet Phys. JETP 4, 259-61(1957) March.

A method for calculating the polarization of neutrons scattered by lead is outlined. The results are shown graphically and are compared to other theoretical and experimental results. (B.J.H.)

5492

THE POLARIZATION OF NEUTRONS FROM THE $D(\gamma,n)$ REACTION. L. N. Rosentsveig (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 280-1(1957) March.

Calculations are made of the polarization of the neutrons from the $D(\gamma,n)$ reaction. (B.J.H.)

Refer also to abstracts 5329 and 5430.

NUCLEAR PHYSICS

5493 HW-47012

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NUCLEAR PHYSICS RESEARCH QUARTERLY REPORT [FOR] JULY, AUGUST, SEPTEMBER 1956. Nov. 5, 1956. 56p. Contract W-31-109-Eng-52. $0.40(OTS).

The Thermal Test Reactor was put in operation and the initial calibrations are described. Measurements of bucklings of enriched uranium-graphite lattices are reported. Results are also given for light water-enriched uranium lattices. A high temperature exponential experiment is described. Calculated curves for the bucklings of some special graphite lattices are given. A method for computing the resonance escape probability is described, and some results are given. A table of disadvantage factors calculated with the P_3 method for a variety of fuel element sizes is included. A comparison of the U^{235} fission cross section and the Au^{197} capture cross section is reported. An experimental value is given for the slow neutron fission cross section of Pu^{240}. Development of a new circulating

line chronotron for measurements in the millimicrosecond region is described. (For preceding period see HW-44525.) (auth)

5494 NEVIS-19

Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Cyclotron Labs.

STUDIES OF LOW ENERGY MESONIC X-RAY TRANSITIONS AND VACUUM POLARIZATION EFFECTS IN MESONIC ATOMS (thesis). Samuel Koslov. June 1956. 78p. Sponsored by ONR and AEC under Contract N6-ori-110, Task No. 1. (CU-101-56-ONR-110-1-Phys.) $12.30(ph OTS); $4.50(mf OTS).

The results of studies of low energy (mainly 20 to 120 kev) mesonic x-ray transitions are presented. Extensive use was made of K absorption edge filters to set precise upper and lower limits on the x-ray energies. An analysis is given of the general factors involved in such measurements. The principle results, previously reported briefly, are upper and lower limits of 208.95 and 206.89 m_e for the μ meson mass if vacuum polarization effects are included and 209.99 and 207.67 m_e neglecting vacuum polarization. Independent values of $\mu = 206.9 \pm 0.2$ and 206.3 ± 0.3 m_e by other methods are incompatible with these results unless vacuum polarization effects are included, and thus give direct evidence for their existence for mesonic atoms. Two independent methods are given for the rapid computation of vacuum polarization corrections for levels having binding $< \sim 1$ Mev. (auth)

5495 AWRE/Trans-1

A NEW METHOD IN THE THEORY OF INTERACTING FERMI PARTICLES. D. N. Zubarev. Translated from Zhur. Eksptl'. i Teoret. Fiz. 25, 548-59(1953). 18p.

A method of what is called "mixed" representation of non-ideal Fermi systems is presented. The essence of the method is that in the wave function for the system, along with the usual variables, the superfluous variables ρ_k are introduced—the Fourier components of the density operator. These variables express not the whole energy of interaction between the particles but only its long-range part. The Hamiltonian of the system in mixed representation, in the form of a second quantization, consists of Fermi and Bose parts and terms representing interactions between them. With the aid of the mixed representation method it is shown that the energy spectrum of elementary excitations of a Fermi gas with weak interaction consists of Fermi and Bose branches. (auth)

5496

POLARIZATION OF FAST NUCLEONS. L. Wolfenstein (Carnegie Inst. of Tech., Pittsburgh). Ann. Rev. Nuclear Sci. 6, 43-77(1956).

Emphasis is placed on the theoretical formalism used in analyzing experiments involved with polarized beams at high energies between 100 and 400 Mev. A survey of such polarization experiments is included. The special case of the scattering of nucleons from a spin-zero nucleus such as He or C is first considered. The more general formalism is also discussed. The spin dependence in nucleon-nucleon scattering is then considered. 109 references. (B.J.H.)

5497

EXCITATION OF NUCLEI BY CHARGED PARTICLES. N. P. Heydenburg and G. M. Temmer (Carnegie Inst. of Washington, D. C.). Ann. Rev. Nuclear Sci. 6, 77-116 (1956).

The excitation of atomic nuclei to discrete low-lying energy levels by the Coulomb field of moving charged particles is reviewed. The excitation of nuclear bound states by electrons is briefly discussed. A more detailed discussion is given on nuclear excitation by heavy charged particles. Included are topics such as Coulomb excitation theory, general features of Coulomb excitation experiments and interpretations of experimental results. 148 references. (B.J.H.)

5498

ISOTOPE SHIFT IN ATOMIC SPECTRA. J. E. Mack (Univ. of Wisconsin, Madison) and Hack Arroe (Montana State Coll., Bozeman). Ann. Rev. Nuclear Sci. 6, 117-28(1956).

The general features of the isotope shift observed in atomic spectra are illustrated. The mass and field effects on the isotope shift are briefly discussed. 158 references. (B.J.H.)

5499

RECENT ADVANCES IN LOW LEVEL COUNTING TECHNIQUES. Ernest C. Anderson and F. Newton Hayes (Los Alamos Scientific Lab., N. Mex.). Ann. Rev. Nuclear Sci. 6, 303-16(1956).

Beta counting methods for measuring natural C^{14} and tritium and γ counting methods for measuring cosmic-ray produced Be^7 and K^{40} content of the human body are reviewed. Double beta decay experiments are also described. Recent experiments on the detection of the neutrino are reviewed. 70 references. (B.J.H.)

5500

ANNUAL REVIEW OF NUCLEAR SCIENCE. VOLUME 6. James G. Beckerley, Martin D. Kamen, and Leonard. I. Schiff, eds. Palo Alto, Calif., Annual Reviews, Inc., 1956. 471p.

Review articles are included on the time variations of primary cosmic rays, the polarization of fast nucleons, the excitation of nucleic by charged particles, the isotope shift in atomic spectra, properties of medium-weight nuclei, generalized acidity in radiochemical separations, the masses of light nuclides, nuclear radiation effects in solids, applications of oxygen isotopes in chemical studies, advances in low-level counting techniques, nuclear reactors for electric power generation, and cellular and vertebrate radiobiology. (B.J.H.)

5501

LAWS OF THE DISTRIBUTION OF THE ARTIFICIAL RADIOACTIVE NUCLEI AROUND THE STABLE NUCLEI. Paul Dassault. Compt. rend. 244, 1108-11(1957) Feb. 25. (In French)

5502

THE INTERACTION OF β DISINTEGRATION WHICH DOES NOT CONSERVE PARITY. Roger Nataf. Compt. rend. 244, 1187-90(1957) Feb. 25. (In French)

The most general conditions of Fierz and Mahmoud-Konopinski are given, without postulating invariance under reversal of time, and the consequences of experimental results are derived. (These confirm the prediction of Lee and Yang and contribute some new data.) The amount of longitudinal polarization of β^- and β^+ particles is also given. (tr-auth)

5503

ON THE MAGNETIC QUADRUPOLE MOMENTS AND ELECTROMAGNETIC TRANSITIONS IN THE COLLECTIVE MODEL. Jean Yoccoz. Compt. rend. 244, 1484-6(1957) March 11. (In French)

5504

INTERNATIONAL CONFERENCE ON ELEMENTARY PARTICLES AND FORTY-FIRST NATIONAL CONGRESS OF PHYSICS, PISA, 12-18 JUNE 1955. Nicola Zanichelli, ed. Nuovo cimento (10) 4, Suppl. No. 2, 1956. 95p.

A large number of papers are included on experimental data concerning heavy unstable particles. Particular emphasis is placed on the decays and properties of τ mesons,

K particles, and hyperons. Other papers are included on the quantum field theory and the interaction between mesons and nucleons. Other miscellaneous papers contain discussions of cosmic radiation, scattering, and various nuclear reactions. (B.J.H.)

5505

ON THE Λ-NUCLEON FORCE AND THE BINDING ENERGY OF THE LIGHT HYPERFRAGMENTS. N. Dallaporta and F. Ferrari. Nuovo cimento (10) 5, 111-22(1957) Jan.

The problem of the binding of a Λ particle in nuclear matter is considered, assuming that the force acting between Λ and nucleon is due not only to the K field but also to the π field; the interaction schemes are: $\Lambda \rightarrow N + \overline{K}$, $N \rightarrow \Lambda + K$, $N \rightarrow N + \pi$, $\Lambda \longrightarrow \Sigma + \pi$. The calculations are done assuming the d'Espagnat and Prentki hamiltonian, with both scalar and pseudovector coupling (spin of the Λ and the Σ equal ½). A good fit to the experimental values for the binding energy of the Λ in light hyperfragments is obtained, if one assumes that the interaction constants for both the π and K forces are of the same order of magnitude as the coupling constant of the ordinary nuclear forces: with this assumption the π force turns out to be the more important for the binding. (auth)

5506

THE LIFETIME OF $^3H_\Lambda$ HYPERFRAGMENTS. M. W. Friedlander (Univ. of Bristol). Nuovo cimento (10) 5, 283-4(1957) Jan.

Details of observed mesonic decays of H^3_Λ hyperfragments are summarized. A value of 3.7×10^{-10} sec was found for the lifetime of the hyperfragment. (B.J.H.)

5507

ELECTRON-PHOTON CASCADES OF HIGH ENERGY IN PHOTOGRAPHIC EMULSIONS. H. Fay. Nuovo cimento (10) 5, 293-8(1957) Jan.

In order to check experimentally the validity of the relations of quantum electrodynamics at high energies, 8 cascades produced by single γ quanta in emulsions were systematically investigated to a shower depth of at least 1.6 radiation units. All pertinent data are tabulated. (B.J.H.)

5508

ON PARITY CONSERVATION AND NEUTRINO MASS. Abdus Salam (St. John's College, Cambridge). Nuovo cimento (10) 5, 299-301(1957) Jan.

5509

PION-NUCLEON INTERACTION AND STRANGE PARTICLES. P. Budini and L. Fonda. Nuovo cimento (10) 5, 306-8(1957) Jan.

A more realistic model is proposed for pion-nucleon scattering. In this model, the quanta of the internal field can be identified with existing particles. (B.J.H.)

5510

ON THE SIGN OF THE REAL CENTRAL PART OF THE NEUTRON-NUCLEUS COMPLEX POTENTIAL. A. Kind. Nuovo cimento (10) 5, 318-20(1957) Jan.

5511

STUDIES IN THE α-PARTICLE MODEL OF NUCLEI. III. CALCULATION OF THE INTERACTION BETWEEN α-PARTICLES. A. Herzenberg (Univ. of Manchester). Nuclear Phys. 3, 1-34(1957) March.

The interaction between α particles is investigated and compared with the requirements of the α-particle model. These are that there should be a short-ranged repulsion to prevent the α particles from overlapping, and an additive attractive force reaching beyond the repulsion. The interaction energy is divided into four components of different origin and properties. These components are a direct interaction (V_D), which is analogous to the Coulomb interaction between ions and which exists only if the nuclear potential has a direct (i.e. non-exchange) tail, a nucleon-exchange interaction (V_X), a polarization interaction (V_{POL}), and the Coulomb interaction E_c. It is shown that where the direct attraction predominates, the α-α interaction energy can be represented by a static potential; at shorter separations of the α particles, V_X predominates and the α-α interaction can be represented by a potential only if one assumes that because of the strongly repulsive nature of V_X one may replace the latter by an effective repulsive potential. The complete interaction potential between α particles which one obtains in this way agrees in order of magnitude but disagrees in shape with the parabolic potentials which have been used in published treatments of the energy spectra of some α nuclei. It is concluded that the attraction between α particles required by the α-particle model can be accounted for if the force between nucleons has a direct component like that in the Serber potential. The mechanism of the attraction entails no more than a small probability of the α particles' being dissolved in nuclei with $A \leq 40$. (auth)

5512

ON THE CONSERVATION LAWS FOR WEAK INTERACTIONS. L. Landau (USSR Academy of Sciences, Moscow). Nuclear Phys. 3, 127-31(1957) March.

A variant of the theory is proposed in which non-conservation of parity can be introduced without assuming asymmetry of space with respect to inversion. Various possible consequences of non-conservation of parity are considered which pertain to the properties of the neutrino and in this connection some processes involving neutrinos are examined on the assumption that the neutrino mass is exactly zero. (auth)

5513

COLLECTION OF IONS PRODUCED BY ALPHA PARTICLES IN AIR. Catharine Wingate, W. Gross, and G. Failla (Columbia Univ., New York). Phys. Rev. 105, 929-30(1957) Feb. 1.

An investigation of the effects of pressure and collector potential on ion collection in air indicates that recombination of ions may occur even when the ionization current is independent of the collecting field. A Po^{210} source of reduced-range alpha particles was used as the central electrode in a cylindrical ionization chamber of sufficiently large dimensions that the residual energy of the particles was absorbed by the gas at pressures greater than 4.5 cm of mercury. Apparently complete ion collection was achieved by reducing the pressure until at 10 cm of mercury a maximum ionization current was obtained which was independent of the collecting field and of further reduction in pressure. The ionization current at atmospheric pressure, though independent of the collecting potential over a large range of voltages, was 3.3% lower. Since field independence has been the usual criterion of saturation, undetected recombination is suggested as a possible cause for the apparent increase of average energy expended per ion pair formed in air (W) by alpha particles of decreasing energy as well as the reported difference between W values for alpha and beta particles. (auth)

5514

ANTIPROTON-NUCLEON ANNIHILATION PROCESS, (ANTIPROTON COLLABORATION EXPERIMENT). W. H. Barkas, R. W. Birge, W. W. Chupp, A. G. Ekspong, G. Goldhaver, S. Goldhaver, H. H. Heckman, D. H. Perkins, J. Sandweiss, E. Segrè, F. M. Smith, D. H. Stork, and L. van Rossum (Univ., of California, Berkeley) and E. Amaldi, G. Baroni, C. Castagnoli, C. Franzinetti, and A. Manfredini (Istituto di Fisica della Universita, Rome). Phys. Rev. 105, 1037-58(1957) Feb. 1.

Thirty-five antiproton stars have been found in an emulsion stack exposed to a 700-Mev/c negative particle beam. Of these antiprotons, 21 annihilate in flight and three give large-angle scatters ($\theta > 15°$, $T_{\bar{p}} > 50$ Mev), while 14 annihilate at rest. From the interactions in flight the total cross section for antiproton interaction: $\sigma_{\bar{p}}/\sigma_0 = 2.9 \pm 0.7$, where $\sigma_0 = \pi R_0^2$ and $R_0 = 1.2 \times 10^{-13} A^{1/3}$ cm is obtained. This cross section was measured at an average antiproton energy of $\bar{T}_{\bar{p}} = 140$ Mev. It is also found that the antiproton-nucleon annihilation proceeds primarily through pion production with occasional emission of K particles. On the average 5.3 ± 0.4 pions are produced in the primary process; of these, 1 pion is absorbed and 0.3 inelastically scattered. From the small fraction of pions absorbed, it is concluded that the annihilation occurs mainly at the surface of the nucleus at a distance larger than the conventional radius. A total energy balance of particles emitted in the annihilation gives a ratio of charged to neutral pions consistent with charge independence. Conversely, assuming charge independence, it is concluded that the energy going into electromagnetic radiation or neutrinos is small. Comparisons with the Fermi statistical model and the Lepore-Neuman statistical model have been made. Good agreement with the experimental results on the annihilation process can be obtained through appropriate choice of the interaction volume parameters. Several different estimates of the antiproton mass are in good agreement and suggest strongly that the antiproton mass is the same as the proton mass within an accuracy of 2½%. A study of the elastic scattering of the antiprotons down to angles of 2° suggests a possible destructive interference between nuclear and Coulomb scattering. (auth)

5515

CATALYSIS OF NUCLEAR REACTIONS BY μ MESONS. L. W. Alvarez, H. Bradner, F. S. Crawford, Jr., J. A. Crawford, P. Falk-Vairant, M. L. Good, J. D. Gow, A. H. Rosenfeld, F. Solmitz, M. L. Stevenson, H. K. Ticho, and R. D. Tripp (Univ. of California, Berkeley). Phys. Rev. 105, 1127-8(1957) Feb. 1.

Fifteen events were observed in a H bubble chamber in which a μ^- meson appears to come to rest in the H and gives rise to a secondary negative particle of 1.7 cm range which in turn decays by emitting an electron. In five of the events, there is a large gap between the primary and secondary track. Explanations for these events are suggested and discussed. (B.J.H.)

5516

DEUTERON STRIPPING REACTIONS AND NUCLEAR SHELL STRUCTURE. Sueji Okai and Mitsuo Sano (Kyoto Univ.). Progr. Theoret. Phys. (Japan) 15, 203-21(1956) March.

The purpose of this paper is to show that the mixing of the configurations can successfully be applied to deuteron stripping reactions when the angular distribution is characterized by two orbital angular momenta, and conversely that the percentage of mixing of the configurations can be determined from the observed relative heights of two peaks in the angular distribution. The calculations are based upon the perturbation theory. The agreement between the calculated and observed angular distributions is good. For the reaction $F^{19}(d,p)F^{20}$, the unexpectedly small reduced widths are reasonably explained from the standpoint of configuration mixing. Through the investigation of $Mg^{25}(d,p)Mg^{26*}$, it is found that spin assignment of the first excited state of Mg^{26} is favorable to 2. Finally the relations between the type of mixing of the configuration used here and other types introduced to explain the quadrupole moments of odd nuclei are discussed. (auth)

5517

A COLLECTIVE DESCRIPTION OF THE SURFACE OSCILLATION OF ATOMIC NUCLEI. Tatsuoki Miyazima and Taro Tamura (Tokyo Univ. of Education). Progr. Theoret. Phys. (Japan) 15, 255-72(1956) March.

Tomonaga's ingenious method of the description of collective surface motion is extended to the case of three dimensional nuclei. In this extension some difficulty appears which was not the case with Tomonaga's two dimensional example, and a method to avert such a difficulty is given. Applying this method a Hamiltonian is derived which contains terms standing in one to one correspondence with those of Bohr's together with other correction terms. A brief calculation of the nuclear surface energy is also performed. The method of collective description mentioned here may be useful for many other problems where the collective motion take place. (auth)

5518

DEUTERON PHOTODISINTEGRATION AT HIGH ENERGIES. Ryozi Susuki (Tokyo Coll. of Science). Progr. Theoret. Phys. (Japan) 15, 536-44(1956) June.

The problem of deuteron photodisintegration at high energies has something to do with meson scattering in the intermediate states. This process has been investigated by making use of the Tamm-Dancoff method which involves the p-wave interaction of virtual mesons. (auth)

5519

THE THEORY OF RADIATIVE K-CAPTURE, I. Jiro Yukawa (Nagoya Univ.). Progr. Theoret. Phys. (Japan) 15, 561-73(1956) June.

The bremsstrahlung spectrum accompanying K-electron capture is calculated for allowed transitions as well as first and second forbidden transitions, including the effect of nuclear Coulomb field. The calculations are done with the second order perturbation method. Capture interactions are adopted of the scalar, vector, tensor, axial vector and pseudoscalar forms. The plane wave approximation used in the previous calculations is improved by correct Coulomb wave function. (auth)

5520

SURFACE RIGIDITY AND SHELL STRUCTURE OF NUCLEI. Toshio Marumori and Shōta Suekane (Kyoto Univ.) and Atsuko Yamamoto (Nagoya Univ.). Progr. Theoret. Phys. (Japan) 15, 582-3(1956) June.

The relation between the surface rigidity of the core of the nucleus and its shell structure is briefly discussed. (B.J.H.)

5521

NUCLEAR QUADRUPOLE MOMENT AND RIGIDITY OF NUCLEAR CORE. Toshio Marumori and Shōta Suekane (Kyoto Univ.) and Atsuko Yamamoto (Nagoya Univ.). Progr. Theoret. Phys. (Japan) 15, 584-5(1956) June.

An analysis based on the shell structure of the nucleus is made of the electric quadrupole moments of "core ± one extra particle" type nuclei. The results are tabulated and compared with the observed moments and with those calculated by the hydrodynamical model. These results agree qualitatively with the observed values. (B.J.H.)

5522

ELECTROMAGNETIC STRUCTURE OF NUCLEONS. D. R. Yennie, M. M. Lévy, and D. G. Ravenhall (Stanford Univ., California). Rev. Mod. Phys. 29, 144-57(1957) Jan.

The theoretical implications of various experiments relating to the electromagnetic structure of nucleons are examined in the light of current field theory. It is concluded either that the nucleon core is about three times as large as would be expected from intuitive considerations of meson theory, or that there is some inconsistency in the present field theory. (auth)

5523

ENERGY DISTRIBUTION OF GAMMA QUANTA FROM A POINT SOURCE OF GAMMA RADIATION IN AN INFINITE SANDY MEDIUM. V. V. Matveev, A. D. Sokolov, and R. S. Shlyapnikov. Soviet J. Atomic Energy 4, 507-12(1956).

Gamma spectra from point sources (Cr^{51}, Zn^{65}, Ra and MsTh) in an infinite sandy medium were studied with the aid of the scintillation spectrometer. The results obtained indicate that when gamma radiation passes through a thickness of sand there takes place an accumulation of soft scattered radiation of energy ~ 50 kev independently of the energy of the initial radiation. (auth)

5524

VAPORIZATION OF METALS BY FISSION FRAGMENTS. F. S. Laptev and B. V. Ershler. Soviet J. Atomic Energy 4, 513-16(1956).

The number of atoms evaporating from the surface of a metal when it emits fission fragments or alpha particles was measured for U^{233} and Pu^{239}. This quantity depends considerably on the presence of an oxide layer on the surface of the metal and for U^{233}-emitting fission fragments changes from 24 to 1200 atoms for a change from an oxidized to a cleaned surface. For Pu^{239} with a cleaned surface the value is 3500 atoms per fragment. For alpha particles leaving Pu^{239} the value is 0.02. Approximate computations indicate that the number of atoms in the zone heated by the passing of the fragment to a temperature insuring evaporation of the metal is for uranium 5.6×10^6. The kinetic energy which the fragment imparts to the atoms of the lattice, apparently exceeds the value accepted in the literature at the present time. (auth)

5525

INSTALLATION FOR RADIOCHEMICAL INVESTIGATIONS WITH A Co^{60} SOURCE OF GAMMA RADIATION WITH AN ACTIVITY OF 280 g-equiv. RADIUM. A. Kh. Breger, V. A. Belynsky, and S. D. Prokudin. Soviet J. Atomic Energy 4, 587-95(1956).

A description is given of an installation in use for irradiation of substances by Co^{60} γ radiation (280 g-equiv. radium) for radiochemical investigations with the use of a standard Co^{60} preparation. The apparatus was developed on the basis of a critical examination of installations described in the literature which are used for such investigations, and in conformity with the demands made upon modern radiochemical experimental work. The design of the apparatus is such as to permit various physicochemical measurements during irradiation, under safe conditions for the operators. The dose rate in the irradiation of objects 20 to 30 cc in volume is 120 r/second, and for objects up to 800 cc in volume, 30 r/second. (auth)

5526

REMARKS ON MIRROR ASYMMETRY IN NUCLEI. B. M. Strutinsky. Soviet J. Atomic Energy 4, 611-17(1956).

The possible reasons for the formation of mirror-asymmetric nuclei and the intensity of electric transitions in such nuclei are considered. (B.J.H.)

5527

PARAPOSITRONIUM ANNIHILATION PROBABILITY, WITH ACCOUNT OF THE FIRST RADIATIVE CORRECTIONS. A. I. Alekseev (Moscow Engineering and Physics Inst.). Soviet Phys. JETP 4, 261-2(1957) March.

Calculations are made of the first radiative corrections to the probability for two photon annihilation of parapositronium in the ground state. (B.J.H.)

5528

PARAMAGNETIC RESONANCE AND THE POLARIZATION OF NUCLEI IN THICK METAL FOILS. M. Ia. Azbel', V. I. Gerasimenko, and I. M. Lifshitz (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 276-8(1957) March.

It is shown that it is possible to polarize nuclei in thick foils at depths from 10^{-2} to 1 cm by means of a high-frequency high-intensity magnetic field. (B.J.H.)

5529

CONNECTION BETWEEN α-DECAY AND NUCLEAR DEFORMATION. S. G. Ryzhanov (Kishinev State Univ.). Soviet Phys. JETP 4, 282-4(1957) March.

A connection between the deformation of the nuclear surface and the relative intensities of α groups in complex α spectra of radioactive nuclei is established. (B.J.H.)

5530

NUCLEAR HYDRODYNAMICS AND INTERPRETATION OF ENERGY WIDTH OF THE NUCLEAR-γ-RESONANCE. Karl Wildermuth and Hans Wittern. Z. Naturforsch. 12a, 39-59(1957) Jan. (In German)

NUCLEAR PROPERTIES

5531 AD-81080

Institute of Tech., Wright-Patterson AFB, Ohio.

THE EXPERIMENTAL DETERMINATION OF SOME NEUTRON PROPERTIES OF A PARAFFIN MODERATOR AT THE UNITED STATES INSTITUTE OF TECHNOLOGY, WRIGHT-PATTERSON AFB, OHIO (thesis). Thomas Bailey Kerr. Mar. 15, 1955. 39p. (GNE-[55]-3).

The Po–Be neutron source owned by the United States Institute of Technology provides a low flux experimental facility. It is housed in a paraffin block which acts as a moderator and a shield to prevent personnel over-exposure. The health hazard to personnel using the source for experimental purposes is very small if reasonable care is practiced while the polyethylene plugs are removed. Maximum permissible exposure rate is exceeded by a factor of approximately 25 immediately in front of the plug hole when the 2-in. diameter plug is removed and the source is left at the center of the block. If personnel avoid direct exposure to the intense fast neutron flux in front of the open hole, maximum permissible exposure rate will not be exceeded, under normal conditions. The experimentally determined cadmium resonance absorption correction factor, F_{cd}, for 0.040-in. cadmium foil covering 114 mg/cm^2 indium foil is 1.165 and compares very favorably with the value obtained by Tittle. The experimental value of Fermi Age, τ, is 29.6 cm^2 at indium resonance energy of 1.4 ev. The diffusion length, L, is affected greatly by the aluminum tube running through the paraffin block. The experimental value of L is 5.5 cm as compared to 2.42 cm for plain paraffin. The aluminum tube also affects the extrapolation distance, d, which is used to calculate the transport mean free path, λ_t. The extrapolation distance, d, was determined to be 0.45 cm and the transport mean free path, λ_t, was calculated to be 0.634 cm as compared to 0.395 cm for plain paraffin. (auth)

5532 AECU-3420

Nebraska. Univ., Lincoln.

STOPPING CROSS SECTIONS OF SOLID HYDROCARBONS FOR PROTONS AND HELIUM IONS OF ENERGY 25-375 KEV. Donald C. Lorents and Edward J. Zimmerman. [1956?]. 14p. Contract [AT(11-1)-35]. $3.30(ph OTS); $2.40(mf OTS).

Experiments for determining the stopping cross sections of solid hydrocarbons for protons and He ions are outlined. The method for preparing thin films of the hydrocarbons is described in detail. (B.J.H.)

5533 NRDC-10

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

MEMORANDUM TO THE NUCLEAR REACTOR DATA COMMITTEE ON LOW-LYING LEVELS IN U^{233}, U^{235}, AND Pu^{239}. P. E. Cavanagh. Dec. 31, 1951. Decl. Dec. 13, 1956. 3p.

Data from various sources on the energy levels in U^{233} U^{235}, and Pu^{239} are reviewed. (B.J.H.)

5534 TNCC(Can)-4

Atomic Energy of Canada Ltd. [Chalk River Project], Chalk River, Ont.

COMMENTS ON THE SIGNIFICANCE OF THE MEASUREMENTS ON Pu^{240} BY F. W. CORNISH AND M. LOUNSBURY (CRC-633). C. H. Westcott. Mar. 7, 1956. 4p.

Discrepancies in the resonance parameters and effective neutron cross sections of Pu^{240} are briefly discussed. (B.J.H.)

5535 WASH-192

Nuclear Cross Sections Advisory Group, AEC.

REPORTS TO THE AEC NUCLEAR CROSS SECTIONS ADVISORY GROUP, LEMONT, ILLINOIS, SEPTEMBER 24-26, 1956. C. W. Zabel. Mar. 18, 1957. 39p. $0.30 (OTS).

Supersedes TNCC-US-15.

The status of nuclear cross section research programs at ANL, BNL, Columbia Univ., Duke Univ., KAPL, LASL, NDA, ORNL, IDO, and UCRL is briefly summarized. Preliminary data and recent developments in measuring techniques and equipment are included. (D.E.B.)

5536

PROPERTIES OF MEDIUM-WEIGHT NUCLEI. K. Way, D. N. Kundu, C. L. McGinnis, and R. van Lieshout (National Research Council, Washington). Ann. Rev. Nuclear Sci. 6, 129-62(1956).

Data are included on ground-state spins, magnetic moments, quadrupole moments, energy levels, and comparative γ-ray lifetimes of medium-weight nuclei. 75 references. (B.J.H.)

5537

THE MASSES OF LIGHT NUCLIDES. J. Mattauch, L. Waldmann, R. Bieri, and F. Everling (Max-Planck-Institut für Chemie, Mainz, Germany). Ann. Rev. Nuclear Sci. 6, 179-214(1956).

Methods for calculating nuclear masses are discussed. The connection between experimental data, or Q-values, and masses or binding energies is briefly reviewed. The general procedure of least squares adjustment of data is discussed. The procedures by which experimental data are to be admitted as input data for the least squares adjustment are also discussed. 15 references. (B.J.H.)

5538

THE ENERGY OF ALPHA PARTICLES FROM U^{234}, U^{238}, AND Th^{232}. B. G. Harvey, H. G. Jackson, T. A. Eastwood, and G. C. Hanna (Atomic Energy of Canada Ltd., Chalk River, Ontario). Can. J. Phys. 35, 258-70(1957) March.

The α-particle energies of U^{234}, U^{238}, and Th^{232} were measured with a grid ionization chamber. The electronic equipment was designed to provide low noise, high resolution, and good long term stability. Ra^{226}, Em^{222}, Po^{218}, Po^{214} and Po^{210} were used as energy standards. An investigation was made of the corrections to the measurements due to variation in pulse rise-time, source thickness, and imperfact shielding of the collector by the grid. It was found that the experimentally observed resolution was satisfactorily accounted for by the combination of these factors and the noise and ionization straggling. Alpha particle pulse heights were measured in terms of the output of a precision pulse generator. The corrected pulse heights were related to the energies of the standard sources by a two-parameter least squares calculation; the standard deviation was never greater than 5 kev. On extrapolating to zero ionization the line so obtained intercepted the energy axis at 83 kev. The α-particle energies deduced using this line were: U^{234} 4.768 ± 0.003, U^{238} 4.195 ± 0.005, Th^{232} 4.007 ± 0.005 Mev. (auth)

5539

THE MASS YIELD CURVE FOR FISSION OF Am^{241} BY NEUTRONS. J. G. Cuninghame (Atomic Energy Research Establishment, Harwell, Didcot, Berks). J. Inorg. and Nuclear Chem. 4, 1-7(1957) Feb.

Relative yields for the fission of Am^{241} by pile neutrons have been measured for mass numbers 89, 91, 95, 97, 99, 111, 113, 115, 121, 131, 132, 136, (shielded), 137, 139, 140, 141, 143, 144, 147 and 153. The peak-to-trough ratio is ~160 and $\bar{\nu}$ is 3 ± 0.5. The light peak has moved two mass units towards the heavy peak when compared with the Pu^{239} thermal fission curve. (auth)

5540

STUDIES OF INELASTIC SCATTERING OF 185 MEV PROTONS ON CARBON. H. Tyrén and Th. A. J. Maris (Univ. of Uppsala). Nuclear Phys. 3, 52-9(1957) March.

Studies of the inelastic scattering of 185-Mev protons on carbon have been performed using a magnetic analyzer. Differential cross sections of protons, exciting clearly resolved levels in C^{12}, are given. (auth)

5541

ELECTRIC MONOPOLE TRANSITION RATE IN Zr^{90}. Martin Deutsch (Massachusets Inst. of Tech., Cambridge). Nuclear Phys. 3, 83-93(1957) March.

The mean life of the 1.75-Mev excited state in Zr^{90} with J = 0, even parity, has been found to be 8.5 ± 3 mμsec by observing delayed coincidences between beta rays from Y^{90} and annihilation radiation due to internal pair creation. This corresponds to $\rho^2 = 0.036$, close to the values for the other three known monopole transition probabilities. (auth)

5542

ISOTOPIC SPIN IMPURITIES. F. C. Barker (Australian National Univ., Canberra). Phil. Mag. (8) 2, 286-7(1957) Feb.

5543

PARAMAGNETIC RESONANCE SPECTRUM OF MANGANESE IN CUBIC MgO AND CaF_2. W. Low (Univ. of Chicago, Ill.). Phys. Rev. 105, 793-800(1957) Feb. 1.

The paramagnetic resonance spectrum of manganese in cubic MgO and CaF_2 has been analyzed at wave lengths of one and three cm. The cubic field splitting in MgO is given by $3a = (+55.9 \pm 0.9) \times 10^{-4}$ cm^{-1}. The twofold degenerate level lies lower than the fourfold degenerate level. The hyperfine structure constant is $A = (-81.0 \pm 0.2) \times 10^{-4}$ cm^{-1}; $g = 2.0014 \pm 0.0005$. The large cubic field splitting and the reduced hyperfine structure point towards considerable covalent bonding. Anomalous intensity ratios of the fine structure lines were observed. In CaF_2 the hyperfine structure constant has a value of $A = (95 \pm 1) \times 10^{-4}$ cm^{-1}. The line width of 40 gauss even at very low concentration prevented any resolution of fine structure. The large line width is probably caused by the interaction of the magnetic electrons with the fluorine ions. (auth)

5544

PARAMAGNETIC RESONANCE AND OPTICAL ABSORPTION SPECTRA OF Cr^{3+} IN MgO. W. Low (Univ. of Chicago, Ill.). Phys. Rev. 105, 801-5(1957) Feb. 1.

The paramagnetic resonance spectrum of the trivalent

chromium ion has been detected at wave length of 1.2 cm. The spectrum is isotropic with one line at g = 1.9800 ± 0.0006. The hyperfine structure of the Cr^{53} isotope in its natural abundance was detected. The hyperfine structure constant A = (1.60 ± 0.03) × 10^{-4} cm^{-1} permits an evaluation of the nuclear magnetic moment as 0.475 nm. The narrow line and the failure to observe any ground state splitting show that the trivalent chromium ion is exposed to a very pure cubic field. There is no indication of associated vacancies with the Cr^{3+} ion. Optical absorption lines were found at 16,000, 22,700, and 29,700 cm^{-1} as well as a beginning of absorption at 46,000 cm^{-1}. The 16,000 cm^{-1} line is caused either by a quartet-doublet transition or by the Cr^{3+} ion. The other absorption lines can be fitted with Dq = 2270 cm^{-1} and the ^4P state at 10,000 cm^{-1} above the ^4F state. An analysis of the paramagnetic and optical absorption spectra indicate very strong crystal field and some covalent bonding. Probably the Cr^{3+} and the surrounding six oxygen atoms have to be regarded as a very tightly knit unit. (auth)

5545

K FLUORESCENCE YIELD OF SEVERAL METALS. Charles E. Roos (Johns Hopkins Univ., Baltimore, Md. and Univ. of California, Riverside). Phys. Rev. 105, 931-5 (1957) Feb. 1.

The K fluorescence yield (w_K) of iron, nickel, copper, and zinc has been measured by the solid angle method. By varying the solid angle subtended by a sample foil at a NaI(Tl) crystal one can distinguish between the collimated primary beam and the isotropically emitted fluorescent x rays. The following new values were obtained: iron −0.308 ± 0.015, nickel −0.366 ± 0.011, copper −0.410 ± 0.012, and zinc −0.446 ± 0.012. In addition, the values for the K fluorescence yield of zirconium, niobium, molybdenum, rhodium, palladium, silver, cadmium, and tin reported earlier, have been redetermined. With the single exception of the value for zirconium, these new values agree quite closely with the earlier values. The average change is approximately 1% or about one third of the previously estimated error. The redetermined values of w_K are as follows: Zr −0.70 ± 0.02, Nb −0.73 ± 0.02, Mo −0.73 ± 0.02, Rh −0.786 ± 0.015, Pd −0.790 ± 0.015, Ag −0.821 ± 0.019, Cd −0.827 ± 0.015, Sn −0.846 ± 0.012. A phosphorescence of the NaI(Tl) crystals with a decay time of 8 ± 2 milliseconds was found, while no sign of a reported 0.2-millisecond decay was observed. (auth)

5546

LEVEL STRUCTURE OF Li^6. Donald H. Lyons (Univ of Pennsylvania, Philadelphia). Phys. Rev. 105, 936-44(1957) Feb. 1.

A theoretical level structure for Li^6 is calculated for the Hu-Massey Gaussian-shape tensor potential and for the Pease-Feshbach Yukawa interaction. The central force splittings are assumed equal to the first-order Majorana separation. The additional splittings produced by the tensor force of the S and of the D states of Li^6 are computed by using a variational method which includes the effect of configuration interaction. An S-state splitting of approximately 2 Mev is found, when the Pease-Feshbach potential is used, with 9% admixture of excited states introduced into the zero-order wave functions. It is shown that the tensor force has little effect on the separation of the $^1S_0$ and $^1D_2$ states. For the Hu-Massey potential, the triplet D states are split in essentially the same way as would result in first order from a vector-type spin-orbit force. In the case of the Pease-Feshbach potential, the effective first-order potential also includes a tensor term, smaller than and opposite sign to the original tensor force. With both potentials, a total multiplet splitting of about 1 Mev is obtained, with the $^3D_3$ state lowest. (auth)

5547

ISOMER IN IRIDIUM-193. F. Boehm and P. Marmier (California Inst. of Tech., Pasadena). Phys. Rev. 105, 974-6(1957) Feb. 1.

An 80.19-kev transition with a half life of 11.9 days and M4 multipolarity has been observed in a neutron-irradiated sample of iridium. The corresponding isomeric state has been assigned to Ir^{193}, which is produced by two successive neutron captures in Ir^{191}. A pile-neutron capture cross section of 1500 barns is found for Ir^{192}. (auth)

5548

ATOMIC DISTRIBUTION IN LIQUID ARGON BY NEUTRON DIFFRACTION AND THE CROSS SECTIONS OF A^{36} AND A^{40}. D. G. Henshaw (Atomic Energy of Canada Ltd., Chalk River, Ontario). Phys. Rev. 105, 976-81(1957) Feb. 1.

The angular distribution of 1.04 A neutrons scattered by liquid argon at 84°K is reported. Small-angle scattering in the pattern is accounted for in terms of isotope incoherence using the same sign for the measured values of the scattering lengths of A^{40} and A^{36}. The transmission cross section of A^{36} was measured for 1.04 A neutrons and found to be 77 ± 9 barns corresponding to a scattering cross section of 73 ± 9 barns. The scattering cross section of A^{40} was measured and found to be 0.36 barn. The scattering curve was transformed to the atomic density distribution $4\pi r^2[\rho(r)-\rho_0]$ for the liquid. The function shows only small oscillations about $-4\pi r^2\rho_0$ for spacings out to 3A. Beyond this the curve oscillates about zero with an amplitude which decreases with increasing radius. The number of neighbors assigned to the first shell of atoms is 8.2. From a comparison of the position of the density cutoff and first density maximum with that expected for a Lennard-Jones 12:6 potential, it is concluded that the effective potential in the liquid has a broader bowl than that given by the Lennard-Jones 12:6 potential. (auth)

5549

ENERGIES OF NUCLEI WITH DIFFERENT PROTON AND NEUTRON SHELLS. S. Goldstein and I. Talmi (Weizman Inst. of Science, Rehovoth, Israel). Phys. Rev. 105, 995-1002(1957) Feb. 1.

Analysis of energies of nuclei in which protons and neutrons occupy different unfilled shells is made on the basis of the shell model. Good agreement of the calculated and experimental energies is obtained in the $s_{\frac{1}{2}}d_{\frac{5}{2}}$ and the $d_{\frac{5}{2}}f_{\frac{7}{2}}$ regions. Parameters characterizing the nuclear interaction were determined. When these are used in the case of K^{42} the right spin is obtained for the ground state. (auth)

5550

ATOMIC MASSES IN THE S–Tl REGION FROM PRECISION Q-VALUE MEASUREMENTS. P. M. Endt (Physich Lab. der Rijksuniversiteit, Utrecht, Netherlands) and W. W. Buechner, C. M. Braams, C. H. Paris, and A Sperduto (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 105, 1002-5(1957) Feb. 1.

Masses of twenty-seven nuclides from S^{32} to Tl^{45} have been computed from precision (error ≤ 20 kev) Q-value measurements. A number of mass cycles occur which were used for statistical adjustment of the input data. The final masses, obtained by taking as a reference point the S^{32} mass published by Niew and co-workers, are compared to the values measured with mass spectrographic and microwave methods. (auth)

5551

ISOMERIC STATE OF W^{181}. A. J. Bureau and C. L.

Hammer (Iowa State Coll., Ames). Phys. Rev. 105, 1006-11(1957) Feb. 1.

An isomeric state of W^{181} is excited by a (γ,n) reaction on W^{182} using the x-ray beam of the Iowa State College 75-Mev synchrotron. The energy and half life of the isomeric state are found to be 366 ± 4 kev and 14.4 ± 0.3 microseconds, respectively. A measurement of the K-shell conversion coefficient yields a value of 0.30 ± 0.03. These experimental data suggest that the transition is of mixed multipole order, 28% E1 + 72% M2. This assignment is in agreement with the transition probabilities computed from Nilsson's wave functions for the first excited state and the ground state of the W^{181} nucleus. (auth)

5552

ATOMIC MASSES IN THE REGION XENON TO EUROPIUM. W. H. Johnson, Jr., and A. O. Nier (Univ. of Minnesota, Minneapolis). Phys. Rev. 105, 1014-23(1957) Feb. 1.

A six-inch double-focusing mass spectrometer employing the peak matching method of measurement has been used to measure 36 atomic masses in the region $130 \leq A \leq 154$ and $54 \leq Z \leq 63$. Atomic masses of 41 radioactive nuclei have then been calculated from mass differences derived from nuclear reaction and β-decay energies. Nucleon binding and pairing energies have been calculated from the resulting mass table. The effect of the shell closure at N = 82 on the systematics of nuclear binding and pairing energies has been investigated in greater detail than has previously been possible. The discontinuity in neutron binding energy, observed in reaction measurements and β-decay systematics, is shown to be caused by a decrease in binding energy of neutrons beyond N = 82 rather than a particular large binding energy at N = 82. The systematic behavior of proton binding and pairing energies is also studied. The nucleon binding and pairing energy results show departures from uniformity in the region near N = 90. Electric quadrupole systematics have also indicated a change in nuclear structure in this region. The present atomic masses are also employed in the isotopic identification of several reactions, in the study of several natural alpha decays, and in the interpretation of several β-decay disintegration schemes. (auth)

5553

ENERGY LEVELS OF Ca^{43}. C. M. Braams (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 105, 1023-7(1957) Feb. 1.

The $Ca^{42}(d,p)Ca^{43}$ and $Ca^{43}(p,p')Ca^{43}$ reactions were investigated with the MIT-ONR electrostatic generator and a magnetic broad-range spectrograph. Bombarding energies from 5.0 to 7.4 Mev were used; targets were made of magnetically separated isotopes. The Q-value of the $Ca^{42}(d,p)Ca^{43}$ ground-state transition is 5.711 ± 0.010 Mev. Thirty excited states of Ca^{43} in the region below 3.43 Mev are well established. (auth)

5554

NUCLEAR ELECTRIC QUADRUPOLE MOMENT OF K^{39}. G. W. Series (Clarendon Lab., Oxford, Eng.). Phys. Rev. 105, 1128(1957) Feb. 1.

5555

NUCLEAR CROSS SECTIONS FOR 900 MeV PROTONS. N. E. Booth, B. Ledley, D. Walker, and D. H. White (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) A70, 209-18(1957) March.

The cross sections of carbon, aluminum, copper, antimony and lead for 900-Mev protons have been measured. Observations were made with a counter telescope in which the final counter subtended a number of different angles at the absorber. Extrapolation of 'poor geometry' results gave the inelastic cross sections. Extrapolations for nuclear cross sections, which require 'good geometry' measurements, were possible only for the lighter elements carbon, aluminum, and copper because of Coulomb scattering. If the nuclear radius R is assumed to follow the form $R = r_0 A^{\frac{1}{3}}$, the value $r_0 = (1.26 \pm 0.03) \times 10^{-13}$ cm is obtained. If the tapered nuclear density distribution of Williams is assumed, a radial parameter of 0.73×10^{-13} cm is obtained. (auth)

5556

EFFECT OF HARD CORE ON THE BINDING ENERGIES OF H^3 AND He^3, I. Takashi Kikuta and Masami Yamada (Univ. of Tokyo) and Masato Morita (Kobayasi Inst. of Physical Research, Kokubunzi, Tokyo). Progr. Theoret Phys. (Japan) 15, 222-36(1956) March.

The binding energies of H^3 and He^3 are calculated assuming two-body forces of exponential type with hard cores, radii of which are taken equal for both the spin singlet and the triplet states. The outside potentials are supposed charge-independent, and are chosen so as to fit the nuclear two-body data in the low energy region. The following results have been obtained concerning the effects of hard core: 1) it diminishes the binding energies of H^3 and He^3 considerably, and 2) the wave function is pushed out so that the Coulomb energy of H^3, which is too large without a hard core, is reasonably reduced to the experimental value for the difference between the binding energies of H^3 and He^3. (auth)

5557

NOTE ON THE NUCLEAR LEVEL OF SPIN 2^+. Mitsuo Sakai (Tokyo Univ.). Progr. Theoret. Phys. (Japan) 15, 416-17(1956) April.

Data concerning the presently known nuclei which have the spin value 2^+ are tabulated. The conclusions which can be drawn from these data are briefly discussed. (B.J.H.)

5558

TOTAL NEUTRON CROSS SECTION OF Ra^{226}. M. I. Pevzner, L. S. Danelyan, and Yu. V. Adamchuk. Soviet J. Atomic Energy 4, 517-20(1956).

The complete cross section of radium was measured in the energy interval 0.022 to 50 ev by means of a mechanical neutron selector. Resonance was found at $E_0 = 0.537 + 0.006$ ev. The resonance parameters, with Doppler spread and resolution of the equipment taken into account, are presented: $\sigma_0 = (3600 \pm 150)$ barn, $\Gamma = (0.029 \pm 0.001)$ ev, $\Gamma_n = (2.1 \pm 0.1) \times 10^{-5}$ ev. (auth)

5559

CROSS SECTION FOR INELASTIC INTERACTIONS OF 14.5 MEV NEUTRONS WITH VARIOUS ELEMENTS. N. N. Flerov and V. M. Talyzin. Soviet J. Atomic Energy 4, 617-20(1956).

Measurements were made of the cross sections for inelastic interactions of 14.5-Mev neutrons with 24 elements, and all results are tabulated. The dependence of the total cross section on atomic weight is also briefly considered. (B.J.H.)

5560

DETERMINATION OF THE BRANCHING RATIO IN THE DISINTEGRATION SCHEME OF Po^{210}. N. S. Shimanskaia (Academy of Sciences, USSR). Soviet Phys. JETP 4, 165-8 (1957) March.

Measurements were made of the branching ratio in the disintegration scheme of Po^{210}. The probability of transition to the excited level Pb^{206} (with an energy of E = 800 kev) was found to be $1.2 \pm 0.2 \times 10^{-5}$. (auth)

5561

RELATIVE CROSS SECTIONS FOR n-p REACTIONS INVOLVING NUCLEI WITH SEVERAL STABLE ISOTOPES. V. N. Levkovskii (Academy of Sciences, USSR). Soviet Phys. JETP 4, 291-2(1957) March.

It had been noted that n-p and n-α cross sections for the various isotopes of an element seem to decrease with increasing isotopic mass number. In order to verify this regularity, n-p reaction cross sections were experimentally determined for nuclei with several stable isotopes, such as Zr, Cd, Ti, Sr, and Ca. (B.J.H.)

Refer also to abstract 5488.

NUCLEAR REACTORS

5562 AECD-3769
Argonne National Lab., Lemont, Ill.
MATERIALS TESTING REACTOR PROJECT. COFFINS AND COFFIN HANDLING. Design Report No. 21. M. P. Paleczny. Dec. 5, 1949. Changed from OFFICIAL USE ONLY Jan. 24, 1957. 15p. Contract [W-31-109-Eng-38]. $3.30(ph OTS); $2.40(mf OTS).

5563 AECD-3770
Argonne National Lab., Lemont, Ill.
MATERIALS TESTING REACTOR PROJECT. ADDENDUM TO REACTOR BUILDING REPORT. Design Report No. 26A. L. E. Link and R. F. Guzik. Nov. 17, 1949. Changed from OFFICIAL USE ONLY Jan. 24, 1957. 4p. Contract [W-31-109-eng-38]. $1.80(ph OTS); $1.80(mf OTS).

5564 AECD-3771
Argonne National Lab., Lemont, Ill.
MATERIALS TESTING REACTOR PROJECT. REACTOR BUILDING WING. Design Report No. 27. R. F. Guzik and L. E. Link. Oct. 12, 1949. Changed from OFFICIAL USE ONLY Jan. 24, 1957. 17p. Contract [W-31-109-eng-38]. $3.30(ph OTS); $2.40(mf OTS).

5565 AECD-3772
Argonne National Lab., Lemont, Ill.
MATERIALS TESTING REACTOR PROJECT. ADDENUM TO REACTOR BUILDING WING REPORT. Design Report No. 27A. L. E. Link and R. F. Guzik. Nov. 25, 1949. Changed from OFFICIAL USE ONLY Jan. 24, 1957. 12p. Contract [W-31-109-eng-38]. $3.30(ph OTS); $2.40(mf OTS).

5566 AECD-3774
Argonne National Lab., Lemont, Ill.
MATERIALS TESTING REACTOR PROJECT. REACTOR BUILDING. Design Report No. 26. R. F. Guzik and L. E. Link. Oct. 10, 1949. Changed from OFFICIAL USE ONLY Jan. 24, 1957. 23p. $4.80(ph OTS); $2.70(mf OTS).

5567 AERE-C/M-298
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THORIUM NITRATE SOLUTION AS A BREEDER BLANKET IN THE H.A.R. PART I. THERMAL STABILITY. P. G. Jones and R. G. Sowden. Dec. 1956. 8p. (HARD(B)/P-26).

The thermal stability of aqueous thorium nitrate solutions has been investigated over a wide range of concentrations and acidities. The most stable solution without added acid contained 79% by weight of $Th(NO_3)_4$; hydrolytic precipitation in this solution took place between 250 and 257°C. Tests with added acid indicate that a solution corresponding to 1 gm Th per gm H_2O must be at least 1.7M in nitric acid to prevent precipitation up to 300°C. Increasing amounts of acid are required as the Th concentration is decreased. For stability at 300°C, the nitrate ion concentration must inevitably be greater than 3M, and conditions distinctly unfavorable to radiation stability are thereby created. (auth)

5568 AERE-E/M-76
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
PROPOSED SIMULATOR FOR REACTOR KINETIC EQUATIONS. T. E. Burnup. Sept. 29, 1953. 12p.

A simulator design is presented for solving reactor kinetic equations to a reasonable accuracy over a larger range than is permitted by normal pile practice. The unit would be able to simulate both positive and negative transients on both sub- and super-critical reactors over as many decades as desired. (D.E.B.)

5569 AERE-N/PC-20
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
VARIATION OF GRAPHITE DAMAGE IN THE REFLECTOR OF BEPO AND THE CALCULATION OF DAMAGE IN GRAPHITE MODERATED PILES. G. H. Kinchin. Oct. 18, 1951. 11p.

The variation of graphite damage in the reflector of BEPO has been measured by using the change in electrical resistance of graphite. From the results of this experiment it has been possible to calculate the variation of damage with distance from an isolated line of slugs. This provides the data necessary to determine the variation of damage over a cell of any graphite moderated lattice. (auth)

5570 AERE-R/R-2112
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EFFECT OF REMOVING PLATE FUEL ELEMENTS UPON THE THERMAL NEUTRON FINE STRUCTURE IN REACTOR ASSEMBLIES. PART 2. D. A. Newmarch. Dec. 10, 1956. 13p.

Part 1 of this report was issued as AERE-R/R-1940.

The effect upon the thermal neutron fine structure of removing a bunch of fuel plates was studied for the case where the resultant gap is either kept empty or filled with a material other than the moderator. It was found that the removal of a bunch of fuel elements together with the surrounding moderator produces no flux distortion. An expression was also obtained for the flux distribution in an assembly where a bunch of fuel elements was replaced by a bunch of elements composed of a different material. (B.J.H.)

5571 AERE-RP/M-53
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
HAZARD FROM NORMAL MARINE ACCIDENTS TO MERCHANT SHIPS PROPELLED BY NUCLEAR POWER PLANTS. B. T. Price. Dec. 28, 1954. 5p.

It is shown that the danger to the British population from radioactive contamination caused by normal shipping accidents (fire, collision, stranding, but excluding war risks) to nuclear propelled merchant ships is likely to be acceptable, unless there are at least 100 such ships operating in the world. (auth)

5572 AERE-RP/R-2013
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DIFFUSION THEORY OF WATER MODERATED REACTOR ASSEMBLIES. D. A. Newmarch. Dec. 10, 1956. 21p.

The criticality expression, resonance escape probability and migration area have been derived on the assumption that all the slowing down takes place by elastic collisions with the hydrogen atoms. The forms of these expressions are almost identical with those obtained by a three group treatment involving a thermal group, a fission energy

group and a fermi age group. The theory suffers from all the deficiencies of diffusion theory, plus the approximation of ignoring inelastic scattering and having all the fission neutrons born at a single energy. However the expressions being relatively simple, indicate the form that the various parameters should take, and should be useful for fitting experimental results. (auth)

5573 ANL-5589
Argonne National Lab., Lemont, Ill.
A GENERAL METHOD FOR COMPARING THERMAL PERFORMANCE OF FUEL ELEMENT GEOMETRIES AND COOLANTS FOR NONBOILING REACTORS. G. A. Freund and A. L. London. Jan. 1957. 30p. Contract W-31-109-Eng-38. $0.25(OTS).

A method is presented for comparing the influence of various fuel element geometries on reactor core shape for different specifications of thermal performance. These include reactor power, ideal pumping power as a fraction of reactor power, coolant used, and the average approach of coolant to fuel element surface temperature. Illustrative examples are given for water, diphenyl, and carbon dioxide (at 450 psi) as coolants, and plate-channels (as in MTR), crossed wires, and sphere beds as fuel element geometries. The method, in its most simple form, is useful primarily for survey-type thermal design studies and, as such, supplements rather than replaces the conventional, detailed methods currently employed in final core designs. (auth)

5574 BMI-1172
Battelle Memorial Inst., Columbus, Ohio.
STUDIES OF MIXING IN THE LOWER PLENUM OF A QUARTER-SCALE FLOW MODEL OF THE PWR REACTOR. Herbert R. Hazard and Abraham Rotkowitz. Feb. 22, 1957. 22p. Contract W-7405-eng-92. $0.25(OTS).

Mixing in the lower plenum of a quarter-scale air-flow model of the PWR reactor was studied by use of SO_2 as a gaseous tracer in air entering one inlet. The concentration of SO_2 in each of the 145 simulated fuel clusters was determined under various operating conditions, and from these concentrations the extent of mixing was determined. It was found that flow from the traced inlet impinged on the bottom of the flow baffle and passed directly upward through simulated clusters in the quadrant above the inlet. The concentration of air from this inlet varied from as much as 90%, above the center of impaction of the inlet jet on the flow baffle, to about 40%, near the edges of the quadrant. The general appearance of isogram plots indicated that flow in each quadrant was similar, with high concentrations of coolant from the inlet under the quadrant. Mixing improved outside the area of direct impaction, approaching complete mixing around the periphery of the model core, where much of the coolant emerged from the shield passages. In two tests under nominally similar conditions, mixing data were reproduced within 5% on a scale in which concentration of air from the traced inlet varied from 0 to 100%. (auth)

5575 BNL-3110
Ferguson (H. K.) Co., New York.
LARGE SCALE EXPERIMENTAL STUDY OF PRESSURE LOSS IN AIR FEED SLOT. Irving Beiley. Mar. 8, 1948. Decl. June 8, 1956. 58p. [For Brookhaven National Lab.] $10.80(ph OTS); $3.90(mf OTS).

The results of the second experimental gap study on a large-scale model at M.I.T. are given. These data are necessary for computation of channel fore-pressures in the Brookhaven Reactor at various air flow rates. (T.R.H.)

5576 CF-55-10-140
Oak Ridge National Lab., Tenn.
A SERIES OF THERMAL, EPITHERMAL AND FAST NEUTRON MEASUREMENTS IN THE MTR. J. B. Trice. Oct. 28, 1955. 93p. Contract [W-7405-eng-26]. $0.50 (OTS).

A series of neutron flux measurements using resonance reactions, np and nα reactions, and threshold energy fission reactions, were performed in one of the horizontal beam holes (HB-3) in the MTR. It was shown that the maximum flux above thermal energy is $(3.1 \pm 0.6) \times 10^{13}$ neutrons $\cdot$ cm^{-2} $\cdot$ sec^{-1} and that the thermal flux maximum is $(2.3 \pm 0.4) \times 10^{14}$ neutrons $\cdot$ cm^{-2} $\cdot$ sec^{-1}. Two separate instrument development programs are described. One is the design, construction and operation of a pneumatic facility for very rapid and safe transfer of materials into and out of the high level neutron field and the other is the development of a series of very small fission chamber probes using threshold fission reactions in very intense radiation fields. Attempts to express results as crude neutron spectra are described. The threshold reaction $Ni^{58}(np)Co^{58}$ was investigated for use as a radiation damage monitor for metals. It was concluded that more information is needed in regard to the reaction cross section before it can be approved for such service. (auth)

5577 CF-57-2-120
Oak Ridge National Lab., Tenn.
TIME BEHAVIOR OF FUEL CONCENTRATIONS IN SINGLE-REGION REACTORS CONTAINING U-233, U-235, Th-232 AND FISSION PRODUCT POISONS. Nathan Gilbert and Paul R. Kasten. Feb. 26, 1957. 18p. Contract [W-7405-Eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Analytical expressions were obtained for the time behavior of fuel concentrations and fuel-feed rates in single-region, spherical, $UO_3-ThO_2-D_2O$ reactors. (auth)

5578 DL-29
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
NATURAL URANIUM–HEAVY WATER REACTORS FOR LOW COST POWER. W. B. Lewis. Feb. 25, 1957. 17p. (AECL-417).

The Canadian experiences in the attainment of low cost power using natural $U-D_2O$ reactors are briefly reviewed. Data concerning the power output and cost estimates of such reactors are included. (B.J.H.)

5579 E.443/N-9
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
ACTIVITIES TO BE EXPECTED IN THE D_2O CIRCUIT IN PROJECT E.443. V. S. Crocker. Jan. 14, 1954. Decl. Dec. 18, 1956. 8p.

The activity to be expected in the D_2O circuit of DIDO is calculated for each nuclear reaction contributing. (T.R.H.)

5580 E.443/N-29
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE RADIAL, TWO GROUP STATISTICAL WEIGHTING FACTOR IN E.443. J. D. McCullen. June 8, 1955. 3p.

Theoretical one and two group thermal flux plots were prepared for DIDO which indicate the effects of inserting a thermal absorber in the core or reflector. (D.E.B.)

5581 E.443/N-30
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
FUEL DEPLETION IN E.443. P. W. Mummery. May 25, 1955. Decl. Jan. 11, 1957. 5p.

The estimated excess reactivity and the effect of fuel depletion on the reactivity of DIDO are briefly discussed. (B.J.H.)

5582 E.443/N-32
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE HIGH FLUX FUEL TESTING REACTOR (RE 775) NUCLEAR DATA SHEET. B. T. Price and E. B. Fossey. June 1955. Decl. Dec. 6, 1956. 17p.

Nuclear calculations for PLUTO were carried out using an extended two-group method. The core and reflector constants are tabulated. Flux curves for the hot, poisoned, undepleted reactor are included. (B.J.H.)

5583 HW-47017(Del.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
AN ULTRASONIC METHOD FOR BOND TESTING REACTOR FUEL ELEMENTS. D. C. Worlton. Nov. 27, 1956. Decl. with deletions Mar. 1, 1957. 19p. Contract [W-31-109-eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Descriptions are given of ultrasonic equipment investigated for determining the integrity of the bonding layer in certain jacketed fuel elements. This method was used to discriminate the size of the unbonded region electronically and also to map the unbonded areas. (auth)

5584 KAPL-1641
Knolls Atomic Power Lab., Schenectady, N. Y.
TWO-DIMENSIONAL r-θ MULTIGROUP CALCULATIONS (Second Edition). E. L. Wachspress. Feb. 1957. 44p. Contract W-31-109-eng-52. $0.35(OTS).

Two-space-dimension r-θ multigroup calculations permit an accurate mockup of complex reactor configurations. Although the theoretical basis for the method is quite simple, the practicability was realized only with the adaptation of high-speed digital computer techniques. Excellent agreement with experiment has been obtained by the r-θ method. (auth)

5585 KAPL-1690
Knolls Atomic Power Lab., Schenectady, N. Y.
RELAXATION TIMES AND MAGNITUDES IN THE THERMAL BOWING OF FUEL ELEMENT JACKETS. W. C. Cohen and J. K. Davidson. Jan. 10, 1957. 25p. Contract W-31-109-Eng-52. $0.25(OTS).

The transient behavior of a two-section fuel element consisting of a UO_2 core surrounded by a stainless steel cladding was analyzed to determine whether bowing of the stainless steel tube could be made to contribute to a prompt negative temperature coefficient. It was indicated by the study that the mechanical bowing effects associated with the thermal expansion of the stainless steel tubing are too small and the relaxation time too great for the mechanism to be effective in providing a prompt negative temperature coefficient. (auth)

5586 NAA-SR-1761
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THE TRANSIENT BEHAVIOR OF A PROTOTYPE REACTOR FUSE IN SIMULATED REACTOR EXCURSIONS. N. E. Huston and R. R. Eggleston. Mar. 15, 1957. 63p. Contract AT-11-1-GEN-8. $0.40(OTS).

An experiment to observe the transient behavior of a prototype reactor fuse is described. The HB-1 beam hole in MTR was used to simulate a reactor excursion by transporting the test capsule rapidly along the axis of the beam hole. An introductory discussion of thermal transients in the trigger assembly is presented and the results of the experiments are compared with analytical and laboratory predictions of the performance. The response time of the trigger element as a function of reactor period (periods of 0.08, 0.29, 1.7, and 3.4 seconds were simulated) was greater than anticipated, but qualitatively the performance was in agreement with predictions. (auth)

5587 NURG/M-5
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
OPTIMUM CONDITIONS FOR A PILE–STEAM TURBINE SYSTEM. O. Pulley. Apr. 1951. Decl. Nov. 22, 1956. 8p.

A brief survey is given of the optimum operating conditions for a system in which the heat generated in a natural uranium, graphite moderated pile is used to raise steam for use in a simple turbine. The objective is maximum power from the turbine, subject to the many limitations imposed by the nuclear physical and mechanical design of the pile and by the steam system. (auth)

5588 NURG/M-21
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
SIMPLE THEORY OF CHANNEL COOLING. O. Pulley. Apr. 1952. Decl. Nov. 22, 1956. 15p.

Simple solutions for the quantities entering into the design of a channel in a pile are obtained by making certain assumptions. These are shown not to introduce great errors and it is found, in particular, that the pressure drop ratio is always small and the coolant velocity does not vary greatly in any reasonable design. Values are given for the approximate output and metal rating in a very simple form. (auth)

5589 NURG/M-50
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE CHOICE OF BLOWER POWER FOR PILE-GENERATOR SYSTEMS. O. Pulley. Jan. 9, 1953. Decl. Nov. 23, 1956. 18p.

The best ratio ϕ_0 of total blower power to pile output is determined from considerations of the fixed and variable costs involved in a system using heat generated by a pile to raise steam for driving a turbo-alternator. Best conditions are defined as those giving minimum unit cost for the electricity generated; alternative conditions are those giving maximum return on the invested capital. The ratio is sensitive to the power conversion efficiency but is not strongly dependent on the relative costs or operating conditions, within the ranges to be expected. A rough rule gives $\phi_0 = 0.20\eta$ to 0.25η. Some consideration is given to the conditions under which the pile-generator system would be competitive with conventional coal-fired power stations. (auth)

5590 NURG/M-51
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EFFECTS OF COSTS AND BLOWER POWER ON THE OPTIMUM CONDITIONS IN A SIMPLE PILE-STEAM GENERATOR SYSTEM. O. Pulley. Jan. 23, 1953. Decl. Nov. 23, 1956. 16p.

Previous results are modified by making the blower power proportional to the steam efficiency. Net output and the unit cost of this output are calculated for various fuel, capital and operating costs. The steam conditions cover the cases of variable heat transfer or finning with a fixed exhaust steam wetness and fixed finning with three values of exhaust wetness, with a range of upper steam temperatures or steam pressures. The results illustrate the value of improvements in the finning system. They also show that the variation in output and unit cost with steam pressure and exhaust wetness is small, over the range considered. (auth)

5591 ORNL-2179
Oak Ridge National Lab., Tenn.
THE REACTIVITY EFFECT OF AN AIR TANK AGAINST ONE FACE OF THE BULK SHIELDING REACTOR. E. B.

Johnson, K. M. Henry, and J. D. Flynn. Mar. 27, 1957. 31p. Contract W-7405-eng-26. $0.25(OTS).

A large air-filled tank was placed against one face of the Bulk Shielding Reactor in order to observe the effect on reactivity as the reflector was changed from water to air. The interest in this type of measurement arises from the use of large air-filled irradiation chambers adjacent to pool-type reactors. The possible sudden flooding of such chambers presents a reactor hazard which could not be adequately treated by existing calculational techniques. Neutron-absorbing curtains (cadmium and boral) were tested to determine their effectiveness in insulating the reactor reactivity-wise from changes inside the void. Experimental equipment that might be placed in the chamber and would give fast-neutron backscattering was simulated in the BSR tests by iron slabs located between the neutron-absorbing curtain and the tank. The largest net reactivity change observed was approximately 3%, which occurred when the reflector on one face of the reactor was changed from water to boral and air. (auth)

5592 TID-3501

Technical Information Service Extension, AEC. UNCLASSIFIED U. S. ATOMIC ENERGY COMMISSION REPORTS ON CIVILIAN POWER REACTORS AND TEST REACTORS. A LITERATURE SEARCH. Thomas W. Scott, comp. Nov. 1956. 5p. $0.10(OTS).

5593 TID-3503

Technical Information Service Extension, AEC. UNCLASSIFIED U.S. ATOMIC ENERGY COMMISSION REPORTS ON REACTOR SAFETY. A LITERATURE SEARCH. Hugh E. Voress, comp. Nov. 1956. 9p. $0.15(OTS).

5594 WAPD-P-721

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. MEASUREMENTS OF f, P, AND ϵ IN SLIGHTLY ENRICHED LOW DENSITY UO_2-FUELED LATTICES. D. Klein, G. G. Smith, and A. Z. Kranz. Aug. 1956. 24p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

Measurements of thermal utilization, resonance escape probability, and fast fission effect have been completed in the 1.3% enriched, low density UO_2-fueled TRX lattices. The density of the oxide (7.53 gm/cm^3) was 68.77% of maximum theoretical density. The oxide was in the form of pellets with a height-to-diameter ratio of about 1. Pellets were loaded in standard aluminum tubing to a height of 48 in. A detailed description of the TRX is given in WAPD-117. These measurements were made in 0.601-in. diameter rods at water-to-metal ratios of 3 to 1, 4 to 1, and 5 to 1 and 0.387-in. diameter rods at water-to-metal ratios of 4 to 1 and 5 to 1. The 0.601-in. diameter rod data have been previously reported but is included for completeness. Where necessary, a brief description of the techniques involved in the measurements is given. The experimental results are compared to the available theoretical results. The oxide data are also compared with the metal data. (auth)

5595 WAPD-PWR-RD-107

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh]. PRELIMINARY DESCRIPTION OF PWR REFUELING AND HANDLING EQUIPMENT SYSTEM. [Dec. 30, 1955]. 51p. [PWR Project]. Contract AT-11-1-GEN-14. $9.30(ph OTS); $3.60(mf OTS).

The fuel handling system for the Shippingport Station is described. Included are the functional requirements for the system, description of the equipment and facilities to be installed, and preliminary operating procedures. (auth)

5596 WAPD-T-259

Westinghouse Electric Corp. [Atomic Power Div.], Pittsburgh.
POWER AND TEMPERATURE CONTROL OF PRESSURIZED WATER COOLED REACTORS. W. H. Hamilton, J. N. Grace, O. R. Meyer, and N. E. Wilson. [June 1955]. 31p. $4.80(ph OTS); $2.70(mf OTS).

Control requirements for pressurized water reactors are described. Embodiments of the systems required for a central station plant and for a ships propulsion plant are described, in the former case being a temperature reset scheme and in the latter a power regulating system. (auth)

5597 UK/C/5/5

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
U^{235}–H_2O ASSEMBLIES FOR LIDO. [period covered] July and August 1956. C. C. Horton. [1956]. 8p.

Preliminary critical experiments for LIDO are briefly described. (B.J.H.)

5598 UK/C/5/11

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
SOME INTEGRAL MEASUREMENTS RELATED TO NEUTRON SPECTRUM CHARACTERISATION. R. G. Freemantle. [1956]. 5p.

Measurements of reaction rate ratios and cadmium ratios in some light water–uranium lattices are described. Their interpretation in terms of Maxwellian thermal and slowing down epithermal spectrum components requires a more intense epithermal spectrum for the cadmium ratios. (auth)

5599 IGRL-T/R-22

THE PROBLEM OF THE CONTROL OF ATOMIC POWER REACTORS. J. Grabscheid. Translated by T. Scott from Trans. World Power Conf. 5th Conf., Vienna, 1956, Paper 274J/19. 17p.

Factors in the control and stabilization of power reactors are reviewed. Discussions are included on the temperature coefficient of reactivity, the dependence of control speed for natural regulation on the mean neutron lifetime, permissible values of reactor period, and control speed for artificial stabilization by means of automatic control rods. (B.J.H.)

5600

NUCLEAR POWER AND GAS TURBINES–2. JOINT U.S.—SWISS DESIGN STUDY. Atomics 8, 86-92(1957) March.

The design of power generating equipment for a closed cycle gas turbine nuclear power plant of 60 Mw is discussed. (auth)

5601

NUCLEAR POWER FOR SCOTLAND. DETAILS OF THE HUNTERSTON, AYRSHIRE REACTOR. Atomics 8, 93-6 (1957) March.

The design of the reactor and power station now undergoing construction at Hunterston, Ayrshire, Scotland is discussed. (W.L.H.)

5602

NUCLEAR REACTORS FOR ELECTRIC POWER GENERATION. Leon Davidson, William A. Loeb, and Gale Young (Nuclear Development Corp. of America, White Plains, N. Y.). Ann. Rev. Nuclear Sci. 6, 317-52(1956).

Examples of power reactor designs being considered in 1955 are listed. Details on individual reactor designs are included. The more important general technical trends in design are discussed. Power reactor economics are also briefly discussed. 54 references. (B.J.H.)

5603

PILOT PLANT GENERATION OF FISSION PRODUCTS IN URANIUM–BISMUTH REACTOR FUEL. C. J. Raseman, H. Susskind, and C. H. Waide (Brookhaven National Lab., Upton, N. Y.). Chem. Eng. Progr. 53, 86F-92F(1957) Feb.

Molten bismuth, containing 800 p.p.m. of natural uranium and small amounts of corrosion inhibitors, was circulated at pilot scale through the Brookhaven reactor for generation of fission products therein. The recirculating metal stream was equilibrated with fused-salt mixtures and with helium gas to determine distribution coefficients for certain fission products between metal and salt and between metal and gas phases. Experimental results corroborated those previously obtained on small-scale tracer experiments and were favorable from an engineering standpoint. (auth)

5604

FUEL CYCLES IN SINGLE REGION THERMAL REACTORS. PART I. Manson Benedict and Thomas H. Pigford (Massachusetts Inst. of Tech., Cambridge). Chem. Eng. Progr. 53, 96F-104F(1957) Feb.

A discussion is presented on reactors in which fissionable and fertile materials are charged to a single region of a reactor, irradiated for the same length of time, and processed together. (W.L.H.)

5605

NUCLEAR TEST REACTOR GIVING 2,500° F. GASES CAN BE BUILT TODAY. Robert W. Ritzmann (Koppers Co., Inc., Pittsburgh). Chem. Eng. Progr. 53, No. 2, 98, 100 (1957) Feb.

5606

PROBLEMS OF NUCLEAR SHIP PROPULSION. Nuclear Eng. 2, 93-5(1957) March.

The design of a reactor system for installation on a ship entails many considerations entirely different from those of land-based reactors. The unit must have a maximum reliability, operability in bad-weather conditions, and provision for collision. Other requirements would be special docks and tending equipment, and auxiliary propulsion units for maneuvering in small places. (T.R.H.)

5607

BERKELEY NUCLEAR POWER STATION. Nuclear Eng. 2, 96-102(1957) March.

The Berkeley Power Station and the initial construction work on it are described and discussed. (T.R.H.)

5608

THE ENRICO FERMI POWER REACTOR. Nuclear Eng. 2, 112-13(1957) March.

5609

EXPERIMENTAL BOILING WATER REACTOR. FIRST U. S. POWER PLANT OFFICIALLY OPENED. Nuclear Eng. 2, 121-2(1957) March.

5610

TEST REACTORS—THE LARGER VIEW. Nucleonics 15, No. 3, 42(1957) March.

A brief comparison of the ETR and the MTR from the operational experience gained from the MTR is made, after which the conceptual design and operation of the ETR are presented. (W.L.H.)

5611

ETR: CORE AND FACILITIES. R. H. Dempsey, J. J. Jacobson, Salomon Levy, and Bertram Wolfe (General Electric Co., San Jose, Calif.). Nucleonics 15, No. 3, 44-7(1957) March.

The following components of the ETR are discussed; core, in-pile facilities, fuel elements, reflector, control system, instrumentation, pressure vessel, thermal shielding, and fuel handling. (W.L.H.)

5612

ETR: DESIGN AND CONSTRUCTION. Philip D. Bush (Kaiser Engineers, Oakland, Calif.). Nucleonics 15, No. 3, 48-56(1957) March.

The methods are presented of the testing and selecting of the materials for the pressure vessel, piping, and cement for shielding, and of selving some unusual construction problems in the Engineering Test Reactor. (W.L.H.)

5613

ARGONAUT—ARGONNE'S REACTOR FOR UNIVERSITY TRAINING. R. H. Armstrong and C. N. Kelber (Argonne National Lab., Lemont, Ill.). Nucleonics 15, No. 3, 62-5 (1957) March.

The design and operation of the Argonaut, a thermal, heterogeneous, and water cooled reactor for training purposes are described. (W.L.H.)

5614

GAMMA-RAY HEATING IN BSR. F. T. Binford (Oak Ridge National Lab., Tenn.). Nucleonics 15, No. 3, 93-7(1957) March.

To determine the rate of γ heating in Al, Pb, Fe, or Cu structures near reactor cores, temperatures of these materials were measured during heating in the γ field of the BSR and during cooling after being removed from the field. The reactor was operated at constant power and the water temperature remained constant at ~90°F. (W.L.H.)

5615

THE CONTROL AND INSTRUMENTATION OF A NUCLEAR REACTOR. A. B. Gillespie. Proc. Inst. Elec. Engrs. (London) 103, Part B, No. 11, 564-76(1956) Sept.

A survey of the overall instrumentation of a typical research reactor is presented. Emphasis is placed on the less-well-known problems of measurement and control, and to assist in their understanding a brief account is given of the mode of operation of a nuclear reactor. The types of instruments in present-day use are described, and indications are given of their shortcomings. New developments are briefly reviewed. The philosophy of safety-circuit design is outlined, and examples are given of instruments and circuits which conform to this basic code and which have been used on a number of experimental reactors at Harwell. (auth)

5616

SOME DESIGN ASPECTS OF NUCLEAR-REACTOR CONTROL MECHANISMS. G. E. Lockett. Proc. Inst. Elec. Engrs. (London) 103, Part B, No. 11, 597-607(1956) Sept.

Some of the practical design problems associated with the engineering of control mechanisms in nuclear reactors are outlined. Safety is emphasized in all the design aims, and examples are given of some of the systems in use at Harwell. The scope of the paper is limited to control mechanisms for low and moderate-power experimental reactors, although some of the problems which will be met in future power-producing reactors are mentioned. (auth)

5617

FUEL BURN-UP IN NUCLEAR REACTORS. B. L. Ioffe and L. B. Okun. Soviet J. Atomic Energy 4, 529-44(1956).

A method is described of calculating fuel burn-up in nuclear reactors, taking into account the capture and multiplication of neutrons while slowing down. In the calculations, account is taken of the burn-up of U^{235} and the build-up and burn-up of Np^{239}, Pu^{239}, Pu^{240}, Pu^{241} and of the fission fragments. (auth)

5618

BERYLLIUM PHYSICS REACTOR. A. K. Krasin and B. G. Dubovsky. Soviet J. Atomic Energy 4, 605-7(1956).

In order to study the physical properties of a Be-moderated reactor, such a reactor was put into operation at the

USSR atomic electric power station. The parameters of this reactor are listed. (B.J.H.)

NUCLEAR TRANSFORMATION

5619

SUM RULE FOR OPTICAL NUCLEAR REACTIONS. H. Morinaga and D. C. Peaslee (Purdue Univ., Lafayette, Ind.). Nuclear Phys. 3, 115-20(1957) March.

The direct or optical component of nuclear reactions is computed essentially by a first-order pertubation procedure. It should thus be subject to simple sum rules. One such rule is applied to elastic and inelastic α-particles scattering on Ne^{20}, where it is in qualitative accord with the observed smoothing out of fluctuations in the summed angular distributions. (auth)

5620

ON γ-POLARIZATION EFFECTS IN PHOTONUCLEAR REACTIONS. A. Agodi. Nuovo cimento (10) 5, 21-9(1957) Jan.

A detailed derivation is given of the most general angular distribution of photonucleons consistent with the conservation principles for angular momentum and parity. Its azimuthal dependence, when photons are linearly polarized, is discussed, with particular emphasis on the physical information obtainable without using any model for the reaction or the nucleus. (auth)

5621

POLARIZATION OF NUCLEONS FROM PHOTODISINTEGRATION OF DEUTERIUM. W. Czyz (Jagellonian Univ., Krakow, Poland) and J. Sawicki (Univ. of Warsaw, Poland). Nuovo cimento (10) 5, 45-56(1957) Jan.

The polarization of nucleons from the D(γ,n) reaction is investigated under the assumption of tensor coupling in the n-p interaction potential. Dipole electric and dipole magnetic transitions are taken into consideration. The polarization is estimated for $\hbar\omega$ = 40 Mev with the help of recent p-p scattering phase shifts. For sake of illustration the polarization is given for the very singular L·S case and Pais force in Born approximation and for the weak tensor forces of Rarita and Schwinger. The polarization is sensitive to the type of interaction. The general scheme of calculation of the reaction amplitude for tensor forces is given. The quadrupole electric corrections to the polarization are discussed. (auth)

5622

FAST NEUTRON COMPONENT IN PHOTONUCLEAR REACTIONS. F. Ferrero, L. Gonella, R. Malvano, C. Tribuno, and A. O. Hanson. Nuovo cimento (10) 5, 242-8 (1957) Jan.

Preliminary results are given about the fast photoneutron component in many elements with special attention to Al, Cu, Ag, Ba, Au and Bi. (auth)

5623

FURTHER MEASUREMENTS ON n, p REACTIONS AT 14 MeV. II. SULPHUR, ALUMINIUM, IRON, COPPER, NICKEL. L. Colli and U. Facchini (Lab. CISE, Milano). Nuovo cimento (10) 5, 309-14(1957) Jan.

The energy distributions of protons from n,p reactions at 14.5 Mev on Al, S, Fe, Cu, and Ni are presented. (B.J.H.)

5624

^{8}Li EMISSION FROM HEAVY ELEMENT DISINTEGRATIONS PRODUCED BY 5.7 BeV PROTONS. S. J. Goldsack, W. O. Lock, and B. A. Munir (Univ. of Birmingham, Eng.). Phil. Mag. (8) 2, 149-56(1957) Feb.

A stack of Ilford G5 emulsions exposed to the 5.7-bev proton beam of the Berkeley Bevatron has been searched for disintegrations of silver and bromine nuclei with ejected Li^8 fragments, and 91 examples found. The experimental results can be explained qualitatively by assuming that most of the fragments from stars with 12 or more black prongs are ejected as part of the evaporation process but a few of the fragments from the smaller stars (less than 12 black prongs) are ejected during the initial stages of the collision. (auth)

5625

STUDY OF SOME He^3-INDUCED REACTIONS ON C^{12}. D. A. Bromley, E. Almqvist, H. E. Gove, A. E. Litherland, E. B. Paul, and A. J. Ferguson (Atomic Energy of Canada Ltd., Chalk River, Ontario). Phys. Rev. 105, 957-73(1957) Feb. 1.

He^3-induced reactions in carbon have been studied for bombarding energies in the range 1.0 to 3.0 Mev. Absolute excitation curves have been obtained for the proton groups leading to the first three states in N^{14} and for the neutron group leading to the O^{14} ground state; these show pronounced resonance structure corresponding to levels in O^{15}. Angular distributions have been measured at seven different energies for protons and four for neutrons. These distributions are not directly explicable as resulting from either compound nucleus or direct interaction processes but do show marked structure. The threshold for the $C^{12}(He^3,n)O^{14}$ reaction has been determined to be 1449.6 ± 2.8 kev, which requires a mass defect for O^{14} of 12.146 ± 0.0065 Mev. The total cross sections for the (He^3,n) reaction to the O^{14} ground state and for the (He^3,p) reaction to the analog 2.3-Mev state in N^{14} are in the ratio 2:1, and the angular distributions for protons and neutrons from these reactions are quite similar at energies somewhat above the neutron threshold, as would be expected. The total cross sections for the (He^3,p) reaction range from 0.03 to 25 mb at these energies. The cross section of the $C^{12}(He^3\alpha_4)C^{11}$ reaction has been found to be approximately an order of magnitude greater than that of the $C^{12}(He,n_0)O^{14}$ reaction and is suggestive of direct interaction. (auth)

5626

PROTONS FROM THE INTERACTION OF 14 MeV NEUTRONS WITH MEDIUM WEIGHT NUCLEI. D. L. Allan (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Proc. Phys. Soc. (London) A70, 195-208(1957) March.

The energies of the protons emitted by Al^{27}, Fe^{54}, Fe^{56}, Ni^{58}, Ni^{60}, and Cu^{63} when bombarded by 14-Mev neutrons have been determined using a photographic plate method. In addition, the angular distribution of the protons emitted by Cu^{63} has been measured. The energy distribution of the protons is consistent with some of them being produced by the (n, np) reaction and others by a direct interaction. Rough cross sections for these processes are given; in the course of the work a cross section of 10 ± 4 mbn has been measured for the reaction Fe^{54}(n, 2n). The results, generally, are in good agreement with the statistical and direct interaction theories. (auth)

5627

INTERPRETATION ON NITROGEN- AND PROTON-INDUCED NUCLEAR REACTIONS. Ryuzo Nakasima, Yoshihisa Tanaka, and Ken Kikuchi (Osaka Univ.). Progr. Theoret. Phys. (Japan) 15, 574-81(1956) June.

Excitation functions for α-, 2p- and 2α-emissions are calculated on the basis of the compound nucleus formalism for both of nitrogen-induced reactions on C^{12} and proton-induced reactions on Mg^{25}. The results are compared with the observed excitation curves in respective cases. A good agreement between the theoretical and the experimental results in (p; 2p), (p; α) and (p; 2α) reactions indicates that the evaporation theory is valid for explaining the intermediate energy reactions even in those light nuclei.

The over-all behavior of observed (N; α) and (N; 2p) excitation curves is in agreement with that obtained by the calculation and suggests that some sort of compound nucleus is formed in the nitrogen induced reaction. However the large magnitude of (N; 2α) cross section cannot be explained by the successive emission of two alpha particles, if the first alpha particle emerges from the conglomerate nucleus proceeding toward the complete compound state. Hence the large (N; 2α) cross section is regarded as due to direct processes such as alpha-capture or stripping. The occurrence of direct processes may explain a small discrepancy in the shape of (N; α) excitation curve at high incident energies. (auth)

5628

THE CROSS SECTION FOR THE REACTION Li^7 (d,p) Li^8 AS A FUNCTION OF DEUTERON ENERGY IN THE RANGE 1.1-4 MEV. L. S. Bezrukov, D. A. Panov, and D. V. Timoshuk. Soviet J. Atomic Energy 4, 609-10(1956).

Deuterons from a 70-cm cyclotron were used to study the reaction $Li^7(d,p)Li^8$. The cross section for the reaction shows resonances at deuteron energies of 2.0, 2.5, and 3.7 Mev. (B.J.H.)

5629

ENERGY DEPENDENCE OF THE FISSION WIDTH. V. G. Nosov. Soviet Phys. JETP 4, 263-4(1957) March.

The energy dependence of the fission width is briefly discussed with emphasis on its dependence near the fission threshold region. It is seen that the dependence of the fission width near threshold is not monotonic. The conclusions which may thus be reached concerning the behavior of the fission cross section in this region are noted. (B.J.H.)

5630

PRODUCTION OF π-MESON PAIRS ON NUCLEI BY HIGH ENERGY γ-QUANTA. A. G. Sitenko (Academy of Sciences, USSR). Soviet Phys. JETP 4, 269-71(1957) March.

Calculations are made of the cross section for the photoproduction of π-meson pairs on nuclei, taking into account the influence of the Coulomb interaction between the π mesons and the charge of the nucleus on the process. (B.J.H.)

5631

PHOTOPRODUCTION OF π-MESON PAIRS IN HYDROGEN AND DEUTERIUM NEAR THRESHOLD AND ISOTOPIC INVARIANCE. N. V. Dushin (Leningrad Polytechnic Inst.). Soviet Phys. JETP 4, 274-6(1957) March.

The cross section for photoproduction of pion pairs in H and D was calculated by considering the interaction of an electromagnetic field with a meson-nucleon system in first order perturbation theory. (B.J.H.)

PARTICLE ACCELERATORS

5632 AERE-GP/M-156

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

LINEAR ACCELERATORS USING THE PRINCIPLE OF SLOAN AND LAWRENCE. R. B. R.-S[hersby]-Harvie. Aug. 18, 1953. 6p.

The figure of merit for an idealized linear accelerator of the Sloan and Lawrence type is calculated and found to vary as $\lambda^{-\frac{1}{2}} v^{-2}$. This leads to very high possible figures of merit at low particle velocities which are comparable with those for modern types of linear accelerator for $v \approx 0.1c$. The theory is roughly compared with the Sloan and Lawrence experiment. It is concluded that the principle is of interest where particle velocities < 0.1c are sufficient. (auth)

5633 AERE-GP/R-2050

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

LINEAR DYNAMICS IN SPIRAL RIDGE CYCLOTRON DESIGN. W. Walkinshaw and N. M. King. Oct. 1956. 44p.

A linearized form of the equations of motion is developed and used to derive expressions for the radial and vertical oscillation frequencies. Taking account of practical requirements, these relations are used to survey possible design parameters for two spiral ridge cyclotrons—a 240-Mev fixed frequency machine, (conversion of 110-in. Harwell synchrocyclotron), and a high energy (3 Bev) accelerator. Particular emphasis is laid on the limitations imposed by the various resonances associated with spiral ridge systems. On this basis it is concluded that the Harwell conversion might be achieved with four ridges (N = 4) on the magnet pole face. A composite ridge system is suggested for the high energy machine, with N small near the center, the number of ridges being doubled before the 240-Mev resonance is encountered. Owing to the prohibitive integral resonance occurring at some energy depending on the chosen N, but always < 938 Mev, the last part of the acceleration must be accomplished with the aid of frequency modulation. The mean field could then have a power law variation, with constant spiral angle, and the working point on the resonance chart would remain fixed. The necessity of extensive non-linear computations in establishing the feasibility of the proposed designs is stressed; the linear dynamics indicates the course which the more accurate studies should take. (auth)

5634

A HIGH-FREQUENCY 500-KILOVOLT COCKCROFT-WALTON ACCELERATOR. Paul Lorrain, Réne Béique, Paul Gilmore, Paul-Emile Girard, Alain Breton, and Pierre Piché (Univ. de Montreal, Can.). Can. J. Phys. 35, 299-312(1957) March.

The 500-kv accelerator described is of the Cockcroft-Walton type and is operated at a frequency of 32 kc. It is pressurized for compactness. The circuit comprises 24 stages and is terminated by an inductive load which increases the output voltage by a factor of 1.5. The rectifer filaments are heated by utilizing the current flowing through the stray capacitances of the rectifiers. The circuit calculations are given and the design is described briefly. (auth)

5635

VARIABLE-ENERGY PARTICLE ACCELERATORS. J. W. Gallop (National Research Development Corp., London). Nature 179, 492(1957) March 2.

5636

FIELD STABILIZATION IN A D.C.—A.C. EXCITED MAGNET OF A SYNCHROTRON. G. Ghigo and I. F. Quercia. Nuclear Instr. 1, 57-61(1957) March.

The shape of the magnetic field of an electron-synchrotron is quite critical at injection. If the machine is fed with an a-c current and with a bias d-c current, the shape of the field at injection is quite sensitive to the values of the peak a-c and d-c current. A device is described that is sensitive to the difference between peak a-c and d-c current and which keeps this difference constant by controlling the value of the d-c current. The apparatus was applied to model magnets of the 1 Bev Italian electron-synchrotron, and is planned for controlling the supply of the synchrotron. (auth)

5637

FINE TIME-STRUCTURE OF BEAMS FROM THE BIRMINGHAM PROTON SYNCHROTRON. N. E. Booth and G. W.

Hutchinson (Univ. of Birmingham, Eng.). Nuclear Instr. 1, 80-5(1957) March.

The radio-frequency time-structure of beams scattered from internal targets in the Birmingham proton synchrotron has been investigated using a delayed self-coincidence technique. The degree of bunching of all the beams commonly used in counter experiments has been investigated and methods of increasing the burst length and destroying the radio-frequency structure are discussed. (auth)

5638

A TARGET BOX FOR BOMBARDMENT OF CF_4 IN GASEOUS OR SOLID FORM. P. B. Treacy and N. F. Bowkett (Australian National Univ., Canberra). Nuclear Instr. 1, 86-9 (1957) March.

The construction and operation is described of a target box in which CF_4, either in gaseous or solid form, can be bombarded by protons and the angular distribution of soft (19 (kev) radiation emitted in the process $F^{19}(p,p'\gamma)$ observed. Examples are given of pulse spectra obtained from solid CF_4 and from a conventional target of CaF_2. (auth)

5639

TWO TARGET OPERATION OF A PROTON–SYNCHROTRON. S. J. Goldsack (Univ. of Birmingham, Eng.). Nuclear Instr. 1, 90-1(1957) March.

A method of placing two targets in the vacuum chamber, one close to the inside edge and one close to the outside edge of the region of stable acceleration, is described. The targets may be in different parts of the machine, and the beam from each may be used separately. (D.E.B.)

5640

TWO LITHIUM ION SOURCES FOR ACCELERATORS. I. Cornides, J. Roósz, and A. Siegler (Dept. for Atomic Physics, Budapest). Nuclear Instr. 1, 94(1957) March.

Two types of Li ion sources developed for the investigation of charge-exchange and nuclear reactions by accelerated Li ions, are described and preliminary results concerning their performance are given. (auth)

5641

DISSOCIATION OF MOLECULAR HYDROGEN IONS (H_2^+) IN GASES. K. K. Damodaran (Univ. of Birmingham, Eng.). Proc. Roy. Soc. (London) A239, 382-93(1957) March 12.

Cross-sections have been measured for the dissociation of 200 kev H_2^+ ions in H_2, D_2, He, N_2, O_2, Ne, A, Kr, Xe, CH_4, H_2S, CO_2 and N_2O. Measurements have also been made at 175, 150 and 100 kev for H_2 and He and at 150 kev for N_2 and A. For each gas and each energy, the mean number of protons produced in the dissociation of a molecular ion has been obtained. For H_2, N_2 and A, observations have been made of the angular distribution of the H^0 particles about the direction of the primary 200 kev H_2^+ ions. (auth)

5642

THE SIX-METER SYNCHROCYCLOTRON OF THE INSTITUTE OF NUCLEAR PROBLEMS, ACADEMY OF SCIENCES USSR. D. V. Efremov, M. G. Meshcheryakov, A. L. Mints, V. P. Dzhelepov, P. P. Ivanov, V. S. Katyshev, E. G. Komar, I. F. Malyshev, N. A. Monoszon, I. Kh. Nevyazhsky, B. I. Polyakov, and A. V. Chestnoi. Soviet J. Atomic Energy 4, 449-57(1956).

The chief characteristics of the six-meter synchrocyclotron of the Institute of Nuclear Problems of the Academy of Sciences, USSR, which provides proton acceleration to an energy of 680 Mev, are described. (auth)

5643

HIGH ENERGY PARTICLES FROM THE SIX-METER SYNCHROCYCLOTRON AND THEIR UTILIZATION. V. P. Dzhelepov, V. P. Dmitrievsky, V. S. Katyshev, M. S. Kozodaev, M. G. Mescheryakov, K. I. Tarakanov, and A. V. Chestnoi. Soviet J. Atomic Energy 4, 459-67(1956).

The problem of increasing the efficiency of utilization of the six-meter synchrocyclotron at the Institute of Nuclear Problems, Academy of Sciences USSR is reviewed. The method by which a large number of particle beams is obtained and collimated is described; using these beams it is possible to carry on several simultaneous experiments. Characteristic beam data are presented. (auth)

5644

BASIC FEATURES OF A PROJECTED 50-60 BEV STRONG-FOCUSING PROTON ACCELERATOR. V. V. Vladimirsky, E. G. Komar, A. L. Mints, L. L. Goldin, D. G. Koshkarev, N. A. Monoszon, S. Ya. Nikitin, S. M. Rubchinsky, S. V. Skachkov, N. S. Streltsov, and E. K. Tarasov. Soviet J. Atomic Energy 4, 479-82(1956).

The basic features of a projected 50 to 60 Bev strong-focusing proton accelerator are described. The critical energy is eliminated by changing the dependence of orbit length on momentum. The weight of the magnetic system, consisting of 120 sectors is less than 22,000 tons, the peak power is approximately 100,000 kva, the mean radius is 236 m. (auth)

5645

THE 10 BEV PROTON SYNCHROTRON OF THE ACADEMY OF SCIENCES USSR. V. I. Veksler, D. V. Efremov, A. L. Mints, M. M. Veisbein, F. A. Bodopyanov, M. A. Gashev, A. I. Zeidlits, P. P. Ivanov, A. A. Kolomensky, E. G. Komar, I. F. Malyshev, N. A. Monoszon, I. Kh. Nevyazhsky, V. A. Petukhov, M. S. Rabinovich, S. M. Rubchinsky, K. D. Sinelnikov, and A. M. Stolov. Soviet J. Atomic Energy 4, 469-78(1956).

A short description is given of the basic parameters and specifications of the 10-Bev proton synchrotron. The various aspects of the design and construction of the accelerator have been considered in greater detail in a series of reports delivered to the accelerator section of the All-Union Conference on the Physics of High Energy Particles. (auth)

5646

INVESTIGATION OF STABILITY OF ELECTRON MOTION IN CYCLIC ACCELERATORS WHEN QUANTUM EFFECTS ARE INCLUDED. A. A. Sokolov, I. M. Ternov, G. M. Strakhovskii (Moscow State Univ.). Soviet. Phys. JETP 4, 251-8(1957) March.

The general case of motion of electrons in cyclic accelerators has been investigated, taking account of quantum effects, when axial as well as radial oscillations are possible. It is shown that the quantum effects can be included by quantizing the adiabtaic invariants according to the Bohr-Sommerfeld method. The effect of quantum fluctuations on radial-phase oscillations in a synchroton is also investigated. Finally, the problem of quantum excitation of macroscopic oscillations is discussed. (auth)

Refer also to abstract 5402.

RADIATION ABSORPTION AND SCATTERING

5647 CF-56-8-126

Oak Ridge National Lab., Tenn.

OPERATING MANUAL FOR ORACLE CODE NO. 243: THE CALCULATION OF GAMMA HEATING IN REACTORS OF RECTANGULAR GEOMETRY. T. B. Fowler and H. C. Claiborne. Aug. 20, 1956. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A method of calculating heat generation due to gamma ray absorption in structural members of reactors of rectangular geometry was coded for the ORACLE. Complete instructions as to preparation of input parameter tapes and performing the calculation on the ORACLE are

given. The code tapes are in possession of the authors and are available upon request. (auth)

5648

ON THE RANGE-ENERGY RELATION OF Li^7 IONS IN NUCLEAR EMULSIONS. Jean-Pierre Lonchamp. Compt. rend. 244, 1486-8(1957) March 11. (In French)

The particles arising from the reaction of Be bombarded by 375-Mev α particles are magnetically separated and collected in C_2 emulsions placed at different values of $H\rho$. The Li^7 group is identifiable; its energy is deduced from that of protons of the same $H\rho$. Six points of the Li^7 range-energy curve are determined. The total curve is discussed in the light of more recent measurements. (tr-auth)

5649

INELASTIC HIGH ENERGY NUCLEON SCATTERING ON LIGHT NUCLEI. A. J. Maris and H. Tyrén (Univ. of Uppsala). Nuclear Phys. 3, 35-51(1957) March.

The excitation of a nucleus bombarded by nucleons of a few hundreds of Mev is considered as the result of individual interactions of the incoming nucleon with the nucleons of the nucleus. A simple two-particle model, in which a bombarding particle excites a particle moving in a potential well, has been calculated in the first Born approximation. It is shown that the resulting angular distributions have a strong forward dip and vanish at large angles. To a certain extent this result still holds for the case of a nucleus consisting of Fermi particles with common and isobaric spins. In first order only those states can be excited whose wave functions have, in the sense of the independent particle model, a component differing only in the state of one particle from the ground state wave function. In the case of neutron scattering the cross section has a forward dip if the space part of the wave function of the excited particle is orthogonal to the space part of its ground state wave function. If this is not so, for example if the excitation can occur by a pure spin exchange, there may be a forward maximum. In proton scattering the Coulomb interaction could result in a forward peaked angular distribution by dipole excitation as well as in the above mentioned case of a monopole transition. In higher approximation two or more particles in the nucleus can be simultaneously excited. The resulting cross sections are expected to be smaller and more isotropic than in the case of a one-particle excitation. The angular distributions for two types of collective excitation have also been calculated, in the first Born approximation, namely for the lowest quadrupole surface vibration and for the dipole vibration of the nuclear charge. The qualitative features of the experimentally measured cross sections of the scattering of 185-Mev protons on C^{12} are shown to be in agreement with the theoretical expectations. (auth)

5650

FURTHER DEVELOPMENT OF A NEW APPROXIMATE ONE-VELOCITY THEORY OF MULTIPLE SCATTERING. C. C. Grosjean. Nuovo cimento (10) 5, 83-101(1957) Jan.

In two preceding papers, dealing with a new approach for solving one-velocity multiple scattering problems in infinite homogeneous media, approximations for the particle density and current have been derived and studied in detail. Within the framework of the same formalism, the present article concerns the calculation of five further terms in the spherical harmonics expansion of the angular density. From a complete spherical harmonics analysis of the well-known transport equation (carried out in the Appendix), three rigorous continuity conditions relating the unknown coefficients to the density and the current components are derived. In the special case of an isotropic point source, these equations reduce to one single equation and the propounded problem can be solved without great difficulty due to the existing symmetry properties. The solution is then generalized to the case of a given distribution of isotropic sources and both the «direct beam» and the «scattered» contributions to the various coefficients are calculated. The results have all been obtained in the case of slightly non-isotropic scattering, which evidently includes isotropic scattering as a special case. They are finally introduced in the expansions of the scattered particle density and the total density. These formulae will play an important role in a further extension of the new formalism to finite medium problems. (auth)

5651

A SIMPLE TREATMENT OF MESON-NUCLEON SCATTERING. S. F. Edwards and P. T. Matthews (Univ. of Birmingham, Eng.). Phil. Mag. (8) 2, 176-81(1957) Feb.

It is shown that the p-wave meson-nucleon scattering cross sections can be very simply explained by calculating the first order effective potential between meson and nucleon and the scattering in this potential. Some comments are made on the S-wave problem and virtual heavy meson effects. (auth)

5652

THE ELASTIC SCATTERING OF PROTONS BY PROTONS AT 925 MeV. P. J. Duke, W. O. Lock, and P. V. March (Univ. of Birmingham, Eng.), W. M. Gibson and J. G. McEwen (Queen's Univ., Belfast) and I. S. Hughes and H. Muirhead (Univ. of Glasgow). Phil. Mag. (8) 2, 204-14 (1957) Feb.

Ilford G5 emulsions have been exposed to a 925-Mev beam from the Birmingham proton synchroton. Sixty-five examples of the elastic scattering of protons by free protons in the emulsion have been found in 1539 meters of track. After removal of events having azimuthal angles ϕ >45° where ϕ is the angle between the plane of the two secondary particles and the plane of the emulsion, the remaining 44 events yielded a total elastic cross section of 17 ± 3 mb. The angular distribution of all the events shows a strong forward peak in the center of mass system. The shape of this distribution has been compared with the predictions of a simple optical model and a value of $(0.9 \pm 0.1) \times 10^{-13}$ cm has been found for the interaction radium of the proton. The results are compared with other experimental work. (auth)

5653

QUASI-ELASTIC COLLISIONS OF 925 MeV PROTONS. J. G. McEwen and W. M. Gibson (Queen's Univ., Belfast) and P. J. Duke (Univ. of Birmingham, Eng.). Phil. Mag. (8) 2, 231-44(1957) Feb.

Quasi-elastic collisions of protons with protons bound in nuclei have been examined in G5 emulsions exposed to 925-Mev protons from the Birmingham synchrotron. The directions of the secondary particles have been used to obtain values for two components of the momentum of the bound protons. The observed momentum distribution may be described approximately by the function $\exp(-K/7) + 0.05 \exp(-K/40)$, where K is the energy of the bound proton in Mev. The results show that (2.2 ± 0.3)% of all nuclear reactions in the emulsion are quasi-elastic collisions with angle greater than 30° in the C-system of the two protons. This figure agrees with a calculation based on a semi-transparent nuclear model. The calculation indicates that such events contribute about 5% of the interactions with the light nuclei and about 0.7% of those with the heavy nuclei in the emulsion. (auth)

5654

ELASTIC SCATTERING OF LOW-ENERGY ELECTRONS BY ATOMIC NITROGEN AND ATOMIC OXYGEN. Lawrence Baylor Robinson (The Ramo-Wooldridge Corp.,

Los Angeles, Calif.). Phys. Rev. 105, 922-7(1957) Feb. 1.

The phase shifts and elastic scattering cross sections of atomic nitrogen and oxygen for low-energy electrons have been calculated with central field potentials. Most emphasis has been placed on the Hartree-Fock potentials. In the low-energy range, the WBKJ approximation gives an indefinitely increasing cross section, whereas the integration of the differential equation yields finite cross sections in the limit of zero energy, for both nitrogen and oxygen. The Hartree potential does not allow for the existence of a bound state (negative ion) in either case. The Thomas-Fermi potential, although not reliable for low atomic numbers, does allow for the existence of a bound state (of approximatley zero energy) in the case of oxygen. (auth)

5655

NUCLEAR SCATTERING OF 50- TO 130-MEV γ RAYS. George E. Pugh, Ricardo Gomez, David H. Frisch, and G. Sargent Janes (Mas achusetts Inst. of Tech., Cambridge). Phys. Rev. 105, 982-95(1957) Feb. 1.

Using targets of H, D, Li, Be, C, Cu, and Sn, the energy distribution of scattered γ rays at 45°, 90°, and 135° was measured. In first approximation one would expect a scattering cross section given by the coherent addition of Thomson scattering amplitudes for Z free protons. Important deviations, probably of mesonic origin, are observed above 90 Mev. Below 70 Mev in complex nuclei there is an increase in cross section which probably results from nuclear resonance scattering. At small angles in the forward direction, large numbers of inelastically scattered γ rays, which apparently result from inner bremsstrahlung associated with electron pair production, were observed. (auth)

5656

SCATTERING OF NUCLEONS BY NUCLEI IN THE 30-MEV REGION. L. R. B. Elton and L. C. Gomes (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 105, 1027-33(1957) Feb. 1.

The experimental results on the inelastic scattering of 31-Mev protons by medium and heavy nuclei cannot be explained by compound nucleus processes. It is shown here that neither can they be explained by knock-on scattering taking place throughout the nuclear volume, since most of the protons that enter the nucleus are trapped into a compound nucleus by total internal reflection at the nuclear boundary. Good agreement with experiment is obtained on the assumption that the scattering is very largely due to target nucleons that can be treated as momentarily free in the extreme diffuse rim of the nucleus. (auth)

5657

MESON-NUCLEON SCATTERING IN THE TAMM-DANCOFF METHOD. Katsumi Tanaka (Argonne National Lab., Lemont, Ill.). Phys. Rev. 105, 1109-12(1957) Feb. 1.

The lowest-order old Tamm-Dancoff equation for pion-nucleon scattering without the closed loop contribution, is renormalized by using Cini's method. It is found that the spurious pole of the modified propagator including the nucleon self-energy effect does not appear for any momenta and for energies of the system where the lowest-order renormalization scheme is expected to be valid. For the $T = {}^3/_2$ $P_{3/2}$ state, a good fit with the experimental results up to 300 Mev is obtained with $G_1^2/4\pi = 11.6$. For the $T = {}^3/_2$ $S_{1/2}$ state, the value $G_1^2/4\pi = 12.5$ is required to give rough agreement with the experimental results up to 200 Mev. (auth)

5658

DISPERSION RELATIONS FOR FORWARD SCATTERING OF SPIN ZERO PARTICLES BY AN EXTENDED POTENTIAL. F. Mandl (Atomic Energy Research Establishment, Harwell, Berks). Proc. Phys. Soc. (London) A70, 183-7 (1957) March.

Dispersion relations are derived for the scattering in the forward direction of spin zero (scalar or pseudoscalar) particles by a real, extended potential. The contribution from the bound states is expressed in terms of the residues of the bound-state wave functions in momentum space at the resonance energies. (auth)

5659

ELASTIC SCATTERING OF ALPHA-PARTICLES BY HEAVY ELEMENTS. Bobuo Oda and Kichinosuke Harada (St. Paul's Univ., Tokyo). Progr. Theoret. Phys. (Japan) 15, 545-60(1956) June.

The elastic scattering of 13 to 42 Mev alpha-particles by heavy elements has been analyzed, using the boundary condition model of Feshbach and Weisskopf and the optical model with a complex potential of exponential shape in addition to the Coulomb potential. Results for Ag and Au have been compared with experiments for the energy dependence of the elastic scattering and its angular distribution at 22 Mev. As for the energy dependence the experimental data have been fitted fairly well with the results derived from both models, but for the angular distribution the agreement between experiments and theories is less satisfactory, especially for Ag data. The best-fit procedure compels us to assume a considerably larger value for the radius of the alpha particle than the usually accepted value, $R_\alpha \sim 1.2 \times 10^{-13}$ cm, using $R = r_0 A^{1/3}$ with $r_0 = 1.5 \times 10^{-13}$ cm for the nuclear radius. (auth)

5660

ROTATIONAL EXCITATION WITH NEUTRON INELASTIC SCATTERING. Masaru Yasuno (Kyoto Univ.). Progr. Theoret. Phys. (Japan) 15, 586-8(1956) June.

It has been shown experimentally that the excitation function of the inelastic scattering of neutrons depends on the nature of the excited states of the nucleus. The collective model is used to describe the compound nucleus and the target nucleus, and the excitation function is calculated according to the compound theory of Teichmann and Wigner. (B.J.H.)

5661

INELASTIC SCATTERING OF NUCLEONS BY NUCLEI. Ryoichi Kajikawa and Wataro Watari (Hiroshima Univ.) and Tatuya Sasakawa (Kyoto Univ.). Progr. Theoret. Phys. (Japan) 16, 152-4(1956) Aug.

The use of a perturbation method for calculating the inelastic scattering of a nucleon by the nucleus is discussed. The particular example of protons inelastically scattered by Fe^{56} is given. (B.J.H.)

5662

CYLINDER RADIATION AND ACTIVATION. A. V. H. Masket, R. L. Macklin, and H. W. Schmitt (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 28, 189-90(1957) March.

In the calculation of the interaction of radiation from a point source with a body, a somewhat complex exponential integral must be evaluated. If the interaction in the body is small, however, the integral may be approximated by $I = \int v\, dv/R^2$, where V is the volume of the body and R is the distance from the point to the volume element dv in the body. This integral is discussed and applied to the case of a cylindrical body. (auth)

5663

ELASTIC SCATTERING OF NEUTRONS BY 580 MEV PROTONS. Iu. M. Kazarinov and Iu. N. Simonov (Academy of Sciences, USSR). Soviet Phys. JETP 4, 161-4(1957) March.

Differential cross sections were measured for elastic scattering of neutrons by 580-Mev protons in the angular region $\theta = 35$ to 180° (in the system of the center of inertia) with a 2° angular resolution. The character of the obtained

$\sigma_{np}(\theta)$ dependency indicates that at ~ 600 Mev there arises in the neutron-proton system a noticeable interaction in states with orbital moments up to $l \approx 6$. The results obtained do not contradict the hypothesis of charge independences. (auth)

5664

THE SCATTERING OF π^+-MESONS ON HYDROGEN. I. ANGULAR DISTRIBUTIONS AT ENERGIES OF 176, 200, 240, 270, AND 307 MEV. A. I. Mukhin, E. B. Ozerov, and B. Pontecorvo (Academy of Sciences, USSR). Soviet Phys. JETP 4, 237-50(1957) March.

The angular distribution of π^+ mesons with energies of 176, 200, 240, 270 and 307 Mev scattered from liquid hydrogen has been studied with the help of scintillation counters. The total interaction cross section π^+ mesons and hydrogen has also been measured by the method of attenuation of the beam. At all energies, except 307 Mev, the data can be well described by a function of the form $d\sigma/d\Omega = a + b \cos\theta + c \cos^2\theta$. (auth)

5665

SCATTERING LENGTHS OF SLOW NEUTRONS ON DEUTERONS. A. S. Davidov and G. F. Filippov (Moscow State Univ.). Soviet Phys. JETP 4, 267-8(1957) March.

Choices of the correct values of scattering lengths of slow neutrons on deuterons are briefly considered. (B.J.H.)

5666

ON THE SCATTERING OF SLOW NEUTRONS BY HYDROGEN MOLECULES. Stig Brimberg. Stockholm. 1956. 125p.

A complete quantum mechanical description of the scattering of slow neutrons by ortho- and parahydrogen molecules, and a detailed numerical evaluation of the theoretical formulae for comparison with available experimental values of the scattering cross section at different neutron energies are attempted. First the three particle problem neutron-diatomic molecule is studied and the Schrödinger equation of this system has been separated into two parts called the neutron equation and the molecule equation. In the neutron equation the spin dependent potential has been used for the interaction between the neutron and the molecule according to Hamermesh and Schwinger (1946). This equation then gives the asymptotic form of the neutron wave equation from which is obtained the differential cross section for scattering of a neutron by a diatomic molecule consisting of two identical atoms. The wave equation of the molecule is then solved with three different potential assumptions representing the chemical bond. The molecule is considered as a rigid rotator, an isotropic harmonic oscillator, and an isotropic anharmonic oscillator described by the Morse potential. When the azimuthal quantum number $1 > 0$ the wave equation of the molecule has been solved only approximately in the cases. Then the differential cross section has been integrated over the unit sphere and a mean value of the integrated cross section has been calculated corresponding to a Maxwell velocity distribution for the molecules at room temperature $T = 300\,^{\circ}K$. This resulting cross section was given a form which is useful for numerical evaluation, most of which has been performed by means of the Swedish mathematical machine BESK. A comparison is made between our numerical results and the available experimental values of Melkonian (1949) for eleven neutron energies in the region 0.0033 to 1.1 ev. Here the harmonic oscillator potential case seems to fit the experimental curve best. By computing the scattering cross section in a hypothetical case where the temperature motion of the scattering hydrogen gas is neglected ($T = 0\,^{\circ}K$), a quantitative measure of the influence of the temperature motion in the neutron energy region 0.0033 to 0.5 ev is obtained. Finally the use of the detailed formulae for some other possible investigations is discussed. A short account has also been given concerning a determination of statistical estimates of the neutron-proton scattering lengths a_0 and a_1. Use has been made of the coherent scattering length of hydrogen obtained by Ringo, Burgy and Hughes (1951), the energy dependence of the neutron-hydrogen scattering cross section determined by Melkonian (1949) and the theoretical results obtained in this work. This study results in $a_0 = (-2.3793 \pm 0.0027).10^{-12}$ cm and $a_1 = (0.5411 \pm 0.0012).10^{-12}$ cm and the corresponding free proton scattering cross section is $\sigma_o = 20.544 \pm 0.033$ barns. (auth)

Refer also to abstract 5469.

RADIATION EFFECTS

5667 NP-6237

Penn-Texas Corp., New York and Martin (Glenn L.) Co., Baltimore.

EFFECT OF IRRADIATION ON SOLIDS: A BIBLIOGRAPHY. Fourth Edition. Helen C. Friedemann, comp. Mar. 1957. 65p.

The Second Edition of this bibliography was issued as NP-5939.

5668

NUCLEAR RADIATION EFFECTS IN SOLIDS. H. Brooks (Harvard Univ., Cambridge, Mass.). Ann. Rev. Nuclear Sci. 6, 215-76(1956).

A review is given of the status of the theory of atomic displacements, with special emphasis on recent modifications and experimental tests of the theory. Data are included on radiation effects in graphite and uranium. Reviews are also included on work with metals and alloys, valence semiconductors, other valence crystals, and ionic crystals. 210 references. (B.J.H.)

5669

THE EFFECT OF NEUTRON IRRADIATION ON THE SURFACE ELECTRICAL PROPERTIES OF THORIA. D. J. O'Connor (Atomic Energy Research Establishment, Harwell, Didcot, Berks.). Chem. Indust. No. 45, 1348-50(1956) Nov.

RADIOACTIVITY

5670 RCSC-10A

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

MASS AND ACTIVITY OF IODINE AND TELLURIUM FORMED IN FAST REACTOR FUEL (U^{235}). J. J. Syrett. Dec. 11, 1952. 7p.

Graphs are given which show the activities of I and Te and the masses of I and Te present in 1 kgm of fission products from U^{235} after irradiation in a reactor for 100 and 200 days and cooling from 1 to 1000 days. The gross activity of 1 kgm of fission products is also shown. (B.J.H.)

5671

ON THE DECAY OF ^{141}Ce. G. B. Zorzoli. Nuovo cimento (10) 5, 289-90(1957) Jan.

The conversion coefficient for the K shell and the ratio between K and L electrons were measured for Ce^{141}. A high-transmission intermediate image β-ray spectrometer was used to measure the β spectrum, and the γ and x radiations were analyzed with a 20-channel pulse analyzer. (B.J.H.)

5672

DECAY OF 2.7-HOUR Sr^{92}. R. L. Heath (Phillips Petroleum Co., Idaho Falls). Phys. Rev. 105, 1011-13(1957) Feb. 1.

The decay of 2.7-hr Sr^{92}, produced as a fission product activity, has been studied using the scintillation method. Gamma rays of energy 0.23 ± 0.02, 0.44 ± 0.04, and 1.37 ± 0.05 Mev were found, with relative intensities of 0.039 ± 0.004, 0.045 ± 0.004 and 1.00, respectively. Beta-ray spectrometry using anthracene and beta-gamma coincidence studies indicate a major beta of 0.545 ± 0.05 Mev in coincidence with the 1.37-Mev gamma ray. Comparison with 4π beta measurements indicate a branching ratio of 90 ± 10% leading to the 1.37-Mev excited state (log ft = 4.3). (auth)

5673

PROPOSAL FOR EXPERIMENTS FOR DETERMINATION OF BETA-DECAY INTERACTION AND THEORY OF TRIPLE CASCADE TRANSITION. Masato Morita (Kobayasi Inst. of Physical Research, Kokubunzi, Tokyo). Progr. Theoret. Phys. (Japan) 15, 445-60(1956) May.

Four new kinds of experiments on angular correlation in 3-, 5-(β 1st) or 6_+(β 2nd) 4_+(γ_1 2) 2_+(γ_2 2) 0_+ are proposed so as to determine definitely ST (or VT) as the β decay interaction. Some other decay schemes also useful for this purpose are discussed. Various angular correlation functions are given for the successive triple transitions of α, β, γ rays and also of the other kind of particles. (auth)

5674

COINCIDENCE MEASUREMENTS OF Bi^{214}. R. Nierhaus and H. Daniel. Z. Naturforsch. 12a, 1-10(1957) Jan. (In German)

5675

ANGULAR CORRELATION OF 199-110 KEV AND 178-131 KEV γ-γ CASCADES IN γ SPECTRA OF Tm^{169}. U. Cappeller and R. Klingelhofer. Z. Naturforsch. 12a, 84-5(1957) Jan. (In German)

SHIELDING

5676 NDA-2015-93

Nuclear Development Corp. of America, White Plains, N. Y.

FINAL REPORT ON SHIELDING CONTRACT FOR 1956. J. Certaine and H. Goldstein. Dec. 31, 1956. 4p. Contract [AT(30-1)-862-Modification No. 31]. $1.80(ph OTS); $1.80(mf OTS).

A brief outline of the NDA shielding materials development program is presented. (D.E.B.)

5677 WAPD-P-663

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].

NEUTRON GAMMA-RAY SHIELDING CALCULATION. D. Schiff. May 1955. 34p. $6.30(ph OTS); $3.00(mf OTS).

The integral network method has been used to study a problem concerning a plane, monodirectional neutron and γ ray fission source normally incident on a plane shield consisting of alternate layers of H_2O and Fe. Values of the neutron and γ-ray space-energy distributions of the scalar flux and the spatial distribution of the dose density are given in graphical form. (B.J.H.)

Refer also to abstract 5490.

SPECTROSCOPY

5678

MODIFICATION OF THE BROOKHAVEN FAST CHOPPER. F. G. P. Seidl, H. Palevsky, D. J. Hughes, and R. L. Zimmerman (Brookhaven National Lab., Upton, N. Y.). Nuclear Instr. 1, 92-3(1957) March.

The phenolic defining slits of the chopper rotor were replaced by steel slits to lower gamma attenuation. (D.E.B.)

5679

THE SPARK SPECTRUM OF AMERICIUM. R. P. Thorne (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Spectrochim. Acta 8, 71-87(1956).

The wavelengths of some 1300 lines of the spark spectrum of Am have been measured in the spectral range 2500 to 8000 A. Below 5000 A they were recorded in the third order of a Baird three-meter grating spectrograph, with an estimated accuracy of ±0.03 A. Wavelengths above 5000 A were determined in the first order with an accuracy of ±0.1 A. The spectrum consisted of a number of strong and a multitude of weaker lines. Some of the lines recorded at the higher dispersion were resolved into flag patterns. (auth)

5680

A NEW POWERFUL SPECTROMETER FOR THE DETECTION OF ATOMIC AND/OR MOLECULAR RAYS. F. Bernhard. Z. angew. Phys. 9, 68-73(1957) Feb. (In German)

THEORETICAL PHYSICS

5681 AERE-GP/M-172

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ON A MOVING BOUNDARY PROBLEM IN ELECTROMAGNETIC THEORY. W. Millar. Feb. 16, 1955. Decl. Dec. 6, 1956. 22p.

A good but not perfect semi-infinite conductor moves along sliding contacts in such a way as to reduce the area of a circuit enclosing magnetic flux; it is required to find the resulting distribution of current and magnetic field in the circuit, and in the body of the conductor. A simple case is treated here, in which the components of field, current and velocity are mutually perpendicular. Using the methods of the Laplace transform, a solution is obtained in the form of a convolution integral, for which a set of typical numerical values are presented. A subsidiary problem, in which the current is confined to the surface of the conductor, is treated first. (auth)

5682

FERMI COUPLING AND MASS AND CHARGE SPECTRA OF BOSONS. B. Jouvet (CERN, Copenhagen). Nuovo cimento (10) 5, 1-20(1957) Jan.

An equivalence theorem between the theory resulting from a scalar Fermi self coupling is demonstrated, and a Yukawa theory postulating a boson coupled with a fermion pair; mass and coupling of this meson have to satisfy equations which are conditions on the meson renormalization constants. It is then shown that the Fermi theory is renormalizable, in the whole. Analysis of the infinities in perturbation theory is given, in view of their substraction. Effective methods for the treatment of Fermi theory are given; their practical use is exemplified. The magnitude of the boson renormalization constant is discussed. (auth)

5683

INTEGRAL EQUATIONS FOR MESON FIELD THEORY. R. L. Mills (Inst. for Advanced Study, Princeton, N. J.). Nuovo cimento (10) 5, 30-44(1957) Jan.

A covariant method of approximating the nucleon Green's function S'_F is described, in terms of the solution of a connected sequence of linear integral equations. Explicit expressions for the matrix elements for processes involving only one real nucleon are derived by formal functional differentiation of S'_F with respect to external boson fields. The solution is renormalized, in the sense that its power

series expansion in the coupling constant g is the same as obtained by enumerating Feynman diagrams and renormalizing term by term. Closed loops are neglected, though virtual nucleon pairs not corresponding to closed loops are included. (auth)

5684

EXTENSION OF THE THOMAS-FERMI-DIRAC STATISTICAL THEORY OF THE ATOM TO FINITE TEMPERATURES. R. D. Cowan (Los Alamos Scientific Lab., N. Mex.) and J. Ashkin (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 105, 144-57 (1957) Jan. 1.

The Thomas-Fermi theory of the atom is generalized to include the effects of temperature as well as exchange. This leads to a nonlinear integral equation for the Fermi electron-momentum distribution function, and the usual Poisson equation for the electron-density distribution. Analytical solutions of the integral equation are given for the limiting cases of near-degeneracy and complete nondegeneracy, and a numerical method of calculating solutions in the intermediate case is described. A complete discussion of the thermodynamics of the atom is given; in particular, it is shown that the Gibbs free energy is the product of the number of electrons and the electronic chemical potential (Fermi energy), despite statements which have been made to the contrary. Numerical results have verified the virial theorem for all Z, T, and atomic volumes. The ratio of the calculated energy for $T = \mathscr{P} = 0$ to the experimental total ionization energy varies from 2.07 for H down to 1.33 for Al, and is presumably still closer to unity for higher-Z elements. Some numerical results are given for iron over the density range 0.1 to 10 times normal and for values of kT from 0 to 1000 ev. Pressures, energies, and entropies are lower than the corresponding values calculated without exchange by as much as 40% at kT = 10 ev, by up to 10% at kT = 100 ev, and by only negligible amounts at kT = 1000 ev. (auth)

5685

TENSOR COUPLING AND THE VECTOR SHELL MODEL. Arnold M. Feingold (Univ. of Illinois, Urbana). Phys. Rev. 105, 944-9(1957) Feb. 1.

Because of the large tensor force contribution to the nuclear binding energy, which results in a situation of near degeneracy for the low-lying states, the tensor force may produce a large mixing of the low states even in the absence of tensor matrix elements between them. The type of coupling among the low-states resulting from this near degeneracy is investigated by perturbation theory; the high-lying states, which are considered largely responsible for the effects of the tensor force, are eliminated by applying closure. An intermediate-coupling model for the low states emerges which is very similar to the customary one based on a vector force in that the effective nuclear potential for the low states is shown to consist of a central two-body force (with a spin-dependence different from that of the elementary two-body central force), plus a strong vector force, plus a tensor force which is probably weaker than the elementary two-body tensor force. The effective vector force is principally a three-body force, and hence may be expected to show a quite different "hole"-particle relationship than the one- or two-body vector forces usually assumed in the shell model. Because of the neglect in the wave function of the high-lying states which are mixed in directly by the tensor force, the model is expected to be valid for light nuclei only. The β decay of B^{12} is discussed briefly, and is shown to be compatible with the tensor force as the sole spin-orbit force in the elementary two-body interaction. (auth)

5686

LEVEL DENSITY OF A SYSTEM OF FERMI PARTICLES. Norbert Rosenzweig (Argonne National Lab., Lemont, Ill.). Phys. Rev. 105, 950-6(1957) Feb. 1.

Formulas for the density of the energy levels of a system of independent Fermi particles are derived which are valid for all values of the excitation energy, and thus a criterion for the validity for the usual (high-degeneracy) formulas is obtained. It is shown that as the energy of the system increases, the degree to which the usual (high-degeneracy) formulas are modified, depends strongly on the distribution of the individual-particle levels. If the levels are spaced uniformly, the corrections are especially small. Applications to nuclei are discussed briefly. (auth)

5687

TWO-NUCLEON INTERACTION AT HIGH ENERGIES AND THE LÉVY POTENTIAL. H. Gelernter (Univ. of Rochester, N. Y.). Phys. Rev. 105, 1068-74(1957) Feb. 1.

The predictions of the Lévy potential for nucleon-nucleon scattering and polarization at high energies have been explored. Most of the computations were made at 162 Mev, although some have also been done at 105 and 348 Mev. Various values of the Blatt-Kalos parameters were tried as well as certain modifications in the coupling constants and the range which surrender approximate agreement with the low-energy data. No satisfactory agreement with the unpolarized and polarized cross sections could be found. The need of a spin-orbit term in the two-nucleon interaction is discussed. (auth)

5688

NUCLEON STRUCTURE IN THE STATIC THEORY. George Salzman (Univ. of Rochester, N. Y.). Phys. Rev. 105, 1076-83(1957) Feb. 1.

The static theory of Chew and Low is used to calculate the form factors for the charge and current of the proton. The cross section obtained with these form factors is found to be in close agreement with the electron-proton scattering data of McAllister and Hofstadter up to 236 Mev. Root-mean-square radii of 6.5×10^{-14} cm for the charge and 9.7×10^{-14} cm for the current are found. The role of an extended core charge is discussed. The value of the coupling constant used is $f^2 = 0.08$. (auth)

5689

PION PRODUCTION IN NUCLEON-NUCLEON COLLISIONS AT ENERGIES NEAR THRESHOLD. D. B. Lichtenberg (Indiana Univ., Bloomington). Phys. Rev. 105, 1084-8(1957) Feb. 1.

A calculation using the Chew theory indicates that nucleon-nucleon and pion-nucleon final-state interactions both play a role in contributing to the pion production cross sections in nucleon-nucleon collisions at energies near threshold. In particular, it is found that the cross section will be enhanced if (1) tensor forces lead to a D-wave nucleon-nucleon final state interaction or if (2) the pion and one of the nucleons is in a state of isotopic spin 3/2 and angular momentum 3/2. Both of these effects are present if the isotopic spin of the initial two nucleons is unity and the isotopic spin of the final nucleons is zero. In the case of deuteron formation, it is found that the two effects are of the same order of magnitude, but depend differently on energy. (auth)

5690

APPLICATION OF FORMAL SCATTERING THEORY TO MANY-BODY PROBLEMS. L. L. Foldy and W. Tobocman (Case Inst. of Tech., Cleveland, Ohio). Phys. Rev. 105, 1099-1100(1957). Feb. 1.

It is pointed out that the Lippmann-Schwinger integral equation, as it is usually written, does not necessarily have a unique solution when applied to the motion of three or

more bodies. It follows that a certain amount of caution must be exercised in using the Lippmann-Schwinger equation as the basis for an approximation procedure. (auth)

5691

PION PRODUCTION IN PION-NUCLEON SCATTERING. Jerrold Franklin (Univ. of Illinois, Urbana). Phys. Rev. 105, 1101-8(1957) Feb. 1.

The cross section for the production of one additional pion in a pion-nucleon scattering is calculated using the Chew-Low theory of P-wave pion-nucleon scattering. The transition matrix element for the scattering of one meson into two mesons is defined in terms of exact eigenstates of the total Hamiltonian and an approximate expression is derived which expresses the one- to two-meson matrix element as a product of an elastic scattering matrix element and a meson-emission matrix element. Experimental elastic scattering phase shifts are used in calculating the two-meson cross section. The results of this calculation are used to estimate the effect of two-meson states on elastic scattering. The contribution to the effective range for elastic pion-nucleon scattering is small. Cross sections are also obtained for all possible two-meson charge states from either a π^+ or a π^- meson incident on a proton. Comparison is made with experiment and the recent theoretical work of Barshay. (auth)

5692

ELECTROMAGNETIC RADIATION FROM ELECTRON PLASMA. Satio Hayakawa (Kyoto Univ.) and Noboru Hokkyo (Osaka City Univ.). Progr. Theoret. Phys. (Japan) 15, 193-202(1956) March.

The theory of plasma oscillation developed by Bohm and Pines is extended to involve the coupling between longitudinal and transverse oscillations. The coupling arises from the quantum fluctuation of electrons interacting with electromagnetic field. The coupling energy is found to be $\hbar kv$ approximately, where $\hbar k$ represents the recoil momentum of an electron due to the absorption (emission) of a longitudinal quantum with wave number k and v the velocity of the electron. This coupling may account for the solar outburst of radio waves, if the plasma oscillation is excited in a stream of electrons injected into corona with high velocity. (auth)

5693

ON THE ELEMENTARITY OF THE WEAK BOSON-FERMION INTERACTION, I. Sadao Oneda, Shoichi Hori, and Akria Wakasa (Kanazawa Univ.). Progr. Theoret Phys. (Japan) 15, 300-1(1956) March.

5694

ON THE ELEMENTARITY OF THE WEAK BOSON-FERMION INTERACTION, II. Sadao Oneda, Shoichi Hori, and Akira Wakasa (Kanazawa Univ.). Progr. Theoret. Phys. (Japan) 15, 302-4(1956) March.

5695

HYDRODYNAMICAL THEORY OF THE MULTIPLE PRODUCTION OF PARTICLES IN HIGH ENERGY NUCLEON-NUCLEUS COLLISION. Chikashi Iso and Masatomo Sato (Tokyo Univ. of Education). Progr. Theoret. Phys. (Japan) 15, 510-12(1956) May.

5696

NATURE OF NUCLEAR FORCES INDICATED BY THE PHOTODISINTEGRATION OF THE DEUTERON, II. Shih-Hui Hsieh (Nagoya Univ.). Progr. Theoret. Phys. (Japan) 16, 68-70(1956) July.

5697

NUCLEON MAGNETIC MOMENTS IN Ps-Ps INTERMEDIATE COUPLING MESON THEORY. Akira Kanazawa (Hokkaido Univ., Sapporo) and Masao Sugawara (Roval Inst. of Tech., Stockholm). Progr. Theoret. Phys. (Japan) 16, 95-111(1956) Aug.

Tomonaga intermediate coupling meson theory is applied to the symmetrical ps-ps meson theory, where we have taken account of the nucleon recoil, though non-relativistically, and the S-wave mesons, so as to give the pair damping automatically, besides the conventional P-wave mesons. Magnetic moments have been calculated, retaining up to three bound mesons and allowing virtual transitions to some excited states accompanied by single unbound meson emission. The results turn out to be too small to be consistent with the empirical values for reasonable cut-off momenta and coupling constants. Especially the effect of excited states has been shown to be negligible. Sachs' theorem has been obtained as regards the bound meson contribution. (auth)

5698

THEORY OF CLASSICAL SYSTEMS OF INTERACTING PARTICLES OBEYING A NONCENTRAL INTERACTION LAW. I. A. E. Glauberman (Lvov State Univ.). Soviet Phys. JETP 4, 169-73(1957) March.

The theory of systems of interacting particles with noncentral interaction law is considered on the basis of Bogoliubov's method. Successive approximations are obtained for the distribution functions in the two simplest cases: for a gas consisting of axially symmetric diatomic neutral molecules and for a dipole crystal. (auth)

5699

A QUASI-UNIDIMENSIONAL INTERPRETATION OF THE HYDRODYNAMIC THEORY OF MULTIPLE PARTICLE PRODUCTION. I. L. Rozenthal (Academy of Sciences, USSR). Soviet Phys. JETP 4, 217-24(1957) March.

The hydrodynamic theory of multiple particle production developed by L. D. Landau is based on introducing two stages of liquid breakup—unidimensional motion and conical breakup. The validity range of the second stage is exceedingly difficult to estimate. This work investigates a variant of hydrodynamic theory, in which only the unidimensional stage is considered. This variant is shown to give very good approximation for final temperatures $T_k \sim 1.5$ to 2μ. At $T_k \sim \mu$ the unidimensional approximation (particularly for slow secondary particles) gives a result that is merely of the right order of magnitude. The dependence of the fastest particle on T_k is also investigated. It turns out that the condition $T_k \lesssim \mu$ must be satisfied for the calculated velocity to agree with the experimentally-observed one. This leads to the preliminary deduction that when $T_k \sim \mu$, the interaction cross section of the secondary particles (apparently pi-mesons) is of the same order of magnitude as the geometric cross section. (auth)

5700

A NOTE ON MIXED MESON THEORY. A. D. Galanin and L. I. Lapidus. Soviet Phys. JETP 4, 290-1(1957) March.

TRITIUM AND TRITIUM COMPOUNDS

5701

DISTRIBUTION, PRODUCTION RATE, AND POSSIBLE SOLAR ORIGIN OF NATURAL TRITIUM. Harmon Craig (Univ. of California, La Jolla). Phys. Rev. 105, 1125-7 (1957) Feb. 1.

Calculations of the production rate of natural tritium are briefly discussed. It is also pointed out that it is unlikely that cosmic-ray production can account for the tritium flux into the atmosphere. (B.J.H.)

URANIUM AND URANIUM COMPOUNDS

5702 BMI-1098
Battelle Memorial Inst., Columbus, Ohio.
URANIUM ALLOYS FOR HIGH-TEMPERATURE APPLICATION. Henry A. Saller, Ronald F. Dickerson, and William E. Murr. June 25, 1956. Decl. Aug. 3, 1956. 46p. Contract W-7405-eng-92. $0.30(OTS).

Uranium–molybdenum and U-Zr alloys are of interest as power-reactor fuels. This report deals with some physical properties of U-3.5, 5, 7, 9, and 12 wt. % Mo and U-3, 5, 7, 10, 15, and 20 wt. % Zr alloys. Results of a heat-treatment study, hot-hardness and dilation data, and the effects of beta and gamma thermal cycling upon cylinders of both alloy groups are given. In general, the addition of either Zr or Mo to U improved elevated-temperature properties. Uranium–molybdenum alloys possessed greater strengths at elevated temperatures than U-Zr alloys. Dilation information was obtained upon both U-Mo and U-Zr alloys, in two conditions of heat treatment. A slight decrease in length of U-Zr specimens occurred during dilation studies when cooled from 950°C. Conversely, an increase in length occurred with U-Mo specimens where a transformation was detected. Thermal cycling revealed that U-Mo alloys had a greater degree of thermal stability when cycled above 680°C than did the U-Zr alloys. Uranium-zirconium alloys were thermally stable only if cycled below the transformation temperature. (auth)

5703 NP-6238
Penn-Texas Corp., New York.
BIBLIOGRAPHY ON THE PHYSICAL METALLURGY OF URANIUM. [Period covered] 1953–1956. Helen C. Friedemann, comp. Mar. 1957. 30p.

5704
OXIDE FUEL ELEMENTS FOR HIGH TEMPERATURES. J. H. Handwerk and R. A. Noland (Argonne National Lab., Lemont, Ill.). Chem. Eng. Progr. 53, 60F-2F(1957) Feb.

The properties and fabrication of ThO_2–UO_2 fuel elements are discussed. (W.L.H.)

PATENTS

CHEMISTRY

5705
PRODUCTION OF URANIUM. R. P. Linstead, F. M. Burstall, and T. V. Arden. (to U. K. Atomic Energy Authority). British Patent 759,900. Nuclear Eng. 2, 130(1957) March.

Selective precipitation of U is effected by adjustment of the pH and control of the anions and the oxidation state of the metals. To an aqueous solution containing U, Cu and/or Al is added a soluble phosphate or arsenate in quantity sufficient to combine with all the U; the pH of the solution is adjusted to 2.5 by an alkali. Where the atomic ratio of Al to U exceeds 1:1, $(NH_4)_3PO_4$ or $(NH_4)_2SO_4$ may be added in quantity sufficient to combine with all the U and Al. The pH is then adjusted by means of an alkali to 1.8 to 2.0 to precipitate U. (auth)

5706
SULPHUR-DIOXIDE LEACHING OF URANIUM-CONTAINING MATERIAL. (to Minister of Mines and Technical Surveys of Canada). British Patent 760,191. Nuclear Eng. 2, 130(1957) March

This is a process involving low reagent and equipment cost, particularly suitable for the treatment of low-grade ores (pitchblende) or mill tailings. Finely divided material containing U at least partly in U^{4+} form and free from metallic Fe, is leached with an aqueous solution containing SO_2 in the presence of a soluble Fe^{3+} salt, a soluble Mn salt or mixtures thereof and with aeration of the solution. The amounts of salts required and the rate of aeration should be sufficient for the oxidation of the U^{4+} to the U^{6+} state. In order to precipitate the U from the leach solution, the pH of the solution is adjusted to about 1.25 and Fe powder is added in the presence of a precipitant (soluble phosphates, arsenates or fluorides). As free Fe should not be present in the initial material, any such Fe should be removed during the grinding of the material by magnetic separation, otherwise premature precipitation may be caused. (auth)

5707
PRODUCTION OF RADIOACTIVE IODINE-131. C. C. Evans and J. Stevenson. (to U. K. Atomic Energy Authority). British Patent 763,865. Nuclear Eng. 2, 130(1957) March.

Tellurium in a tubular silica container is irradiated with thermal neutrons in a nuclear reactor. The container is then placed in a silica vessel in an electric furnace and heated above boiling point. The I^{131} is distilled off and collected in aqueous caustic alkali. Thus the production itself is carried out in a single step, capable of automatic control and without production of radioactive effluent. (auth)

PHYSICS

5708
METHOD OF AND APPARATUS FOR MEASURING THE THICKNESS OF MATERIALS. (to Exatest Ges. für Messtechnik m.b.H., Germany). British Patent 763,667. Nuclear Eng. 2, 130(1957) March.

The thickness of hot-rolled sheet metal is controlled by electromagnetic radiation sufficiently penetrating so as to be scattered by the electrons of the material. This secondary scattered radiation is proportional to the thickness of the material. Cobalt and caesium isotopes are suitable, and of particular value is the positron-radiating isotope Na^{22}. (auth)

5709
TREATMENT OF MATERIALS BY ELECTRONIC BOMBARDMENT. M. C. Crowley-Milling. (to Metropolitan-Vickers Electrical Co. Ltd.). British Patent 764,337. Nuclear Eng. 2, 130(1957) March.

High-energy electron beams (produced, for example, by a linear accelerator, a Van de Graaff generator, a betatron) are capable of penetrating substances to a considerable depth, thereby effectively destroying living organisms (bacteria). For uniform irradiation, an elongated cross-sectional shape of the beam across which the material will be moved is desirable. The beam is produced in a closed chamber, passes through a window (metal foil) and is then subjected to a magnetic field, causing the beam to traverse a curved path and to spread laterally in the plane of curvature. (auth)

5710
GAMMA-RAY ABSORPTIVE GLASS. (to Corning Glass Works (U.S.A.)). British Patent 764,575. Nuclear Eng. 2, 130(1957) March.

Conventional high-density silicate glasses containing PbO or PbO and BaO are highly absorptive, but their content of CeO_2 to prevent darkening makes the transmission too low even at thicknesses of 3 ft. to permit satisfactory vision so that such glass cannot be used to replace a glass cell. It has now been discovered that if the glass contains at least 17% K_2O, and if the total alkali metal oxide content does not exceed 25%, it can be employed as a window in

"heavy" concrete. A number of compositions showing sufficient gamma-ray absorption without too much loss of vision are possible. (auth)

5711

NEUTRON LOGGING APPARATUS. J. Tittman. (to Schlumberger Well Surveying Corporation). British Patent 765,100. Nuclear Eng. 2, 130(1957) March.

In order to reduce the masking effect of drilling mud in borehole logging, a pad of material is provided for displacing the mud in the space where the neutrons migrate across the wall of the borehole. This pad is made of a material transparent to neutrons, e.g., solid Al. The neutron source may be a Ra–Be pellet, the shield material Cd or B_4C. (auth)